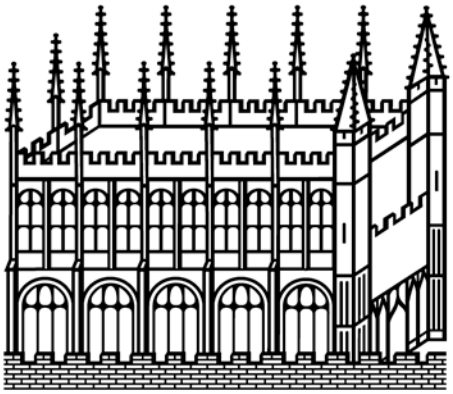


AN ACCOUNT OF THE STOPPING OF DAGGENHAM BREACH:

With the ACCIDENTS that have attended the ſame from the firſt UNDERTAKING.

CONTAINING ALSO

Proper RULES for performing any the like WORK: And PROPOSALS for rendering the Ports of DOVER and DUBLIN (which the Author has been employ'd to Survey) Commodious for Entertaining large SHIPS.

To which is PREFIX'D,

A Plan of the LEVELS which were over-flow'd by the BREACH.

By Capt. JOHN PERRY.

LONDON:

Printed for BENJ. TOOKE at the Middle Temple Gate in *Fleetſtreet*, and Sold by J. PEELE, at *Lock's-Head* in *Pater-Noſter-Row*. MDCCXXI.

AN

ACCOUNT

OF

Daggenham Breach, &c.

THE Work of Stopping of this Breach after the many wearied and unſucceſsful Attempts of the Land Owners, until they had expended more than the Value of the Land, and given it wholly over as Impracticable; being then deem'd worthy the Conſideration of the PARLIAMENT of ENGLAND, for Preſerving the NAVIGATION of the THAMES: And being generally look'd upon as a Thing tending to the Publick Good, it having been more the common Diſcourſe of Men in Converſation, and more Propoſitions and Schemes Projected and made, both to the

Truſtees and otherwiſe, than I believe was ever before known in the World, relating to a Work of ſuch kind: And finding by the conſtant reſort of People down to the Breach, in the carrying on of my Works, as well Perſons of Diſtinction as others, that there Remains ſtill a particular Curioſity in the Minds of Men to ſee, and be Inform'd of this Matter, and being at the ſame time very ſenſible, by the Expreſſions to me, and Queſtions which are daily ask'd me, particularly ſince my laſt ſtopping the Breach, and by the Rumours about the Town, that ill grounded Notions have been ſuggeſted and taken place, with regard to the unhappy Accidents which I have met with, I will therefore, as well for the giving my ſelf ſome Eaſe in the anſwering ſuch reiterated Queſtions which are put to me, (by almoſt every one I meet) as more particularly for the better Satisfaction of ſuch Perſons, who may be able to make a Judgment of the Truth of what I relate, give the following Account of Matters, as far as I know and have been concern'd in this Affair.

And that I may give ſuch Gentlemen who ſhall favour me with the peruſing of this Paper, the beſt and plaineſt Light in the whole thing, that I can;

I ſhall, *Firſt*, ſpeak of the Nature and Extent of the Breach.

Secondly,

Secondly, ſhall point out the Reſpective Places (as in the Plan hereto prefix'd is laid down,) and Manner in which the ſeveral Attempts before me were made.

Thirdly, Shall ſhow the Reaſons which at the firſt induced the Right Honourable the TRUSTEES appointed by Act of Parliament, to reject the Propoſals which I made to them, and to agree with Mr. *Boſwell:* And afterwards the Occaſion which made them come to the Unanimous Reſolution, of Treating and Contracting with me; together with the Difficulties and Misfortunes which have accompany'd me in my Proceedings.

AND firſt, As to the Nature and Extent of the Breach: It was occaſion'd by the blowing up of a ſmall Sluice or Trunk, made for the Drein of the Land-Waters in the Banks of the *Thames:* And might, if proper and immediate Help had been apply'd, have been eaſily ſtop'd with a ſmall Charge; the Ditch, or Drein, of the Marſh Grounds, which led to ſuch Sluice, being at the firſt blowing up of the Sluice, not above fourteen or ſixteen foot broad, and might, in a Day or two Days time, have been eaſily ſtop'd, by the bringing on a ſmall Dam in Form of a Semi circle, to the *Thames* Wall, if many Hands had been ſet to it, but through the Neglect thereof, the conſtant Force of the Water ſetting in and out of the Levels, ſoon made the Gap wider, and when it once came down to the Moor-logg, Gravel and Sand, which lies but a little way below

the common Surface of the Levels, the Water then gull'd to ſuch a depth, and took ſuch Power, that there was no Remedy found for the maſtery of it.

It is now about Fourteen Years ſince the Breach happen'd, and it has in that length of Time worn and ſpread it ſelf into ſeveral large Branches, like the natural Arms of a River, by the Force and Fall of the Water, returning from off the Marſh Ground upon every reflux of the Tide; the longeſt of which Arms is above a Mile and a half in Extent, and in ſome Places is 4 or 5 hundred Foot in breadth, and from twenty to thirty or forty Foot depth. There is by Computation, about a hundred and twenty Acres of ſolid marſh Ground, waſh'd into the THAMES, in manner above mention'd, the Surface being compos'd of clayie Ground, the next Moorlogg, then about a Foot or fifteen Inches blue Clay, and afterwards Gravel, and a ſort of Quick-ſand, as it has been eſteem'd by the Undertakers before me, but I have found no other than common Gravel and Sand.

This Sullage, take it together, which has in the Courſe of the above time been torn and driven into the River, has firſt, that which has been the heavieſt Part of it, been more immediately lodg'd without the Mouth of the Breach, and in the adjacent Reaches above and below, but that which has been of leſs Ponderoſity, has been carried to a greater diſtance.

It may perhaps ſeem ſomewhat ſtrange, that I mention the Matter of this Sullage, that has been

been diſcharg'd to have been carried above as well as below the Breach, whilſt the ſame has been driven out by the Tide of Ebb only: But whoever conſiders, that in the windings of a River, where there is a Flux and Reflux of a Tide, in many Places where there is an Eddy, and Matter ſubſides upon the Tide of Ebb, there is again a ſtrong courſe of a Current upon the return of the Flood which ſets the other way, will conſequently make no difficulty to believe, eſpecially conſidering the great Quantity of Matter thrown out by the Breach, that the Reaches upwards in the River, have ſuffer'd as well as thoſe below; and I have been inform'd, that ſince the Breach happen'd, there has been found conſiderably leſs Water above in WOOLWICH Reach, where the Men of War have their Moorings.

How Detrimental this has prov'd to ERITH, and other Reaches, I ſhall not protract this Diſcourſe by laying down, but ſhall add, that whatever Sullage has not been lodg'd within the River, as ſome Banks have been known to be thrown up ſince the Breach below GRAVESEND, the reſt it is certain has been carry'd out without the Mouth of the THAMES, where the Stream when it forſakes the Banks ſpreading and looſening its force, the ſtrength of the Current ceaſes, and being met by the continued direct rolling in of the Waves of the Sea towards the Shoar, as is the Caſe of all Barr Places, there ſubſides, (that which is not ſo very light as to float away into the main Sea) and diſtreſſes the Entrance into

the Port; and tho' the encreaſe of ſuch Sullage or addition to our Sands or Flatts, may not perhaps be much obſerv'd or minded in one Age, or the Memory of one Man; yet by the common Wear of the River (parallel to the Proverb, that a continual dropping wears the Stone) it may in the courſe of Time, it's too much to be fear'd, be felt. I will therefore conclude this Point with this Obſervation, that in all Nations who have regard to Trade, where the Rivers are not bounded with Rocks and ſtoney Ground, and have deep and clear Water in the Paſſage, but otherwiſe (as in the THAMES) are ſhallow by Scituation, and Subject to the Lodgment of Sullage, either wthin or without at the Entrance, ſuch as are ſubjected to the continued waſh and wear of their Banks, *&c.* and are called Barr Places, there are ſtrict Laws made to prevent the throwing out of auy Ballaſt, even to a conſiderable diſtance at Sea, or the diſcharge of the leaſt Sullage within, whereby any way to annoy their Rivers.

And if I am not miſinform'd, there is a Law of Ancient ſtanding now in Force in the THAMES, that whatſoever Ship is obſerv'd to heave overboard but a Shovel full of Dirt into the River, ſhall pay five Pounds, and I hear likewiſe that there has been formerly an Act made by the Lord Mayor, Aldermen and Common Council of the City to put a Reſtriction upon the bringing of Sand any more into the City of LONDON, by reaſon that great part thereof is conſtantly

conſtantly waſh'd into the River, but it ſeems the Female Power prevailing in this Affair, the ſaid Order is become entirely neglected.

Further, Whoever will but have the Curioſity to obſerve the Sediment in one Bucket of Water, taken up at the Buoy of the Nore, at the laſt part of the Ebb, when the Current ſets out of the River, and another at high Water, when the Flood ſets in, will find abundantly more Sediment in the Bucket, taken up upon the Ebb every Return of the Tide, even in the calmeſt Weather; and as it cannot thereby be denied, but that there is a continued Out-ſet of Sand and Matter, diſcharg'd by the Mouth of the Thames for ever, ſo the Paſſage called the Flatts, from thence to the Downs, in which ſo many Ships with their rich Ladings have been known frequently to be loſt, as well outward as homeward bound, and none of the Men ever heard of, but have periſhed with the Ships, may in length of time be concluded, will ſtill prove more dangerous and difficult for Ships, which there are too many Inſtances in the World, (as the Port of Chester may be named for one) where Navigation has within the Memory of Man been evidently render'd worſe. And although it be true, there has been a time known in a late Reign (as has been objected to me on this Head) when by the removing of our Buoys and Sea-Marks, our Sands were ſerviceable to us, by rendring the Paſſage of the Enemies Ships dubious and impracticable; yet I hope that is

no reaſon at all, nor never will be, why we ſhould be contented to have our Flatts or Sands, which are as the Barr to our Port, increaſe more than they are, wherever it is in our power to apply the leaſt Remedy to prevent it.

I chuſe to be the more particular upon this Point, becauſe I do not know when any Perſons have, or may make it the particular Buſineſs of their Lives to extend their Thoughts this way: And becauſe all Breaches (the Matter which I am now treating of) muſt certainly be attended with a conſiderable Diſcharge of Sullage into the River; and it being a thing well known, that whatſoever Breaches happen in the THAMES, are generally occaſion'd not from any Damage of the Tide's waſhing down or running over the Tops of the Banks (or Walls) in ſuch places where the Marſh-Ground lies equal on the Inſide with the Foot of the Walls, which happens to be overflow'd, but from the bad Workmanſhip, Decay or Defect of the Sluices or Trunks which are made for the Drein of the Levels; of which I ſhall only mention thoſe, which within a narrow ſpace of Time have happen'd, as this of DAGGENHAM Breach, that upwards of Forty Years ſince at LIMEHOUSE, that more lately at WEST-THOROCH or LONGREACH, about two Miles below PURFLEET, which continued more than Seven Years before it was ſtop'd: again, there has been another Breach, which happen'd by the blowing up of a Sluice in the Levels of DAGGENHAM Beam, not three Years and a half ſince (at Lett. F. in the

the PLAN) as likewiſe there has been ſince I have been concern'd at DAGGENHAM, two or three more Places, particularly one not above half a Mile to the Weſt-ward of me, which has been in imminent Danger of a new Breach, by the defect of a Sluice made of Wood, (a prevailing Cuſtom in ENGLAND) which are generally very unſecure and unskilfully plac'd, and the Navigation of the River, thereby ſtill frequently liable to ſuffer in leſs or greater Meaſure.

Therefore, with all Submiſſion, I think it would be good for the preventing of future Breaches, that there ſhould be a Law made, to oblige ſuch Gentlemen who have their Eſtates on the Banks of the THAMES, to make all their Sluices with Stone cemented with Tarras, eſpecially in thoſe Levels which are of large Extent, and not eaſy to be redeemed when a Breach is made. The Reaſon why Gentlemen have never yet made their Sluices of Stone, and the Cuſtom of making them of Wood, has prevail'd in ENGLAND, is, I believe, through one of theſe two Reaſons, or rather both of them together; as firſt, That Men in ENGLAND have perhaps ſomething in them of the humour of another Country that I have been in, and are not very willing to depart from the way of their Fathers; and Secondly, Becauſe the Ground on the Banks of the THAMES, is, by the Workmen employed, eſteem'd bad for fixing the Foundation of Sluices, and that the Weight of Earth, neceſſary for making the Banks, or Walls, where ſuch Sluices

or Trunks are requir'd to be fix'd, uſually ſubjects them to rack and ſettle down at the Foundation, which is certain would be directly evil in the caſe of Stone, as well as it is too often followed with danger of Leakage and Deſtruction, when made of Wood, in the manner as practis'd in the THAMES: but let the Foundation of ſuch Stone Sluices which I propoſe, be fix'd after the manner which the *Dutch* have built their STADT-HOUSE at AMSTERDAM, and other their Buildings in HOLLAND, and there cannot poſſibly be the leaſt ſettling in the caſes of ſuch Sluices propos'd of Stone, but (humanly ſpeaking) they will endure thouſands of Years, with very inconſiderable Expence or Trouble, after once made, in the maintaining them in repair for ever. Whereas Sluices made of Wood (eſpecially that Part which lies neither wholly wet nor wholly dry) muſt continually be ſubject to moulder and decay; and always require, ſome in twenty, ſome perhaps in thirty or forty Years, the repeated Expence of new building ſuch Sluices: Beſides, the never being free from the Suſpicion of Leakage and Danger, making thereby the Eſtates of ſuch Gentlemen who have them in Poſſeſſion the leſs valuable in the common Eſteem of Mankind, and it being practis'd both in *Holland* and *Flanders*, to build all their Sluices with Stone, or a ſort of Brick made for that purpoſe equally durable in the Water. Therefore why may it not be as reaſonable to put a Reſtriction upon the Building of Sluices with Wood in *England*, to prevent

prevent Miſchief from the Inundation of Water to the Navigation of the River, *&c.* As there is a Law made to Eſtabliſh a Method for the Building of Houſes, to prevent the ſpreading of deſtruction by Fire. I ſhall next proceed to ſhow the reſpective Methods which the Perſons who practiſed before me have went on with, in their attempts to ſtop the preſent Breach.

ABOUT a Fortnight after I came over from RUSSIA, in the Year 1713, a Gentleman who was concern'd in the Endeavours which were then carrying on at the Expence of the Land-Owners came to me, and deſir'd me to go down with him and ſee the work which they had then advanced near to a cloſe as he told me.

I readily waited on this Gentleman believing by the Character which he had given me, that the Work was brought near to the being finiſh'd, and reſolving to have given him, with the reſt of the Land-Owners concern'd, what help I could as to my Advice and Opinion in it, had I ſeen it Practicable to make it effectual in the manner it was begun.

AT my arrival on the ſpot, I found upon the Larboard, or Weſt ſide, going into the Mouth of the Breach, a ſmall Sluice going then to be placed, of about three Foot depth, and ſix Foot width, in the Area or Paſſage, for the Water, and that the Canal which was dug for placing down the Sluice, was not above three Foot and a half depth below the Surface of the Marſh Ground.

UPON my obſerving of this Sluice which was deſign'd to be plac'd at no greater depth, nor of no greater dimenſions, I therefore, as I had above reſolv'd, without any Reſerve, told the aforeſaid Gentleman, that in order to give the greater vent and Eaſe, to the Paſſage of the Water in the Endeavours to ſtop the Breach, I thought it would be proper to have had ſuch Sluice placed both to a greater depth, and of much greater Dimenſion, but in juſtification of the placing of ſuch Sluice as it was begun, he reply'd to me, that it was not the Cuſtom of the River to make Sluices uſually ſo large as that was, nor thought ſafe by Workmen to venture to fix them any deeper, on account of the Moorlogg and bad Ground, which made it eſteem'd to be Impracticable. But theſe Reaſonings have ſince been confuted, in the Practice of placing my Sluices to the depth of the ordinary Low Water Mark, (or very near it) as well as Breadth proportionable thereto, being more than thirty times the Dimenſions in the Area, and on account of the Depth only, I am ſure a Thouſand times more ſerviceable in ſtopping the Breach, than the foreſaid Trunk or Sluice, which they proceeded to fix, could poſſibly be found.

BEING conducted by this Gentleman farther on to the Work, where they were endeavouring to ſtop up the Breach, and being particularly informed by him of what they had done, in the various Attempts made for it, with what they were then further reſolved to put in

Practice:

Practice: And having ſounded the Depths of the Breach, and examin'd what I ſaw needful, it made me then change my Mind of the poſſibility of their being ever able to make the Work effectual, either by any Method they proceeded in, or in the Place where their Deſigns were advanced, and Ships and Machines had been once ſunk; this made me therefore reflect in my Mind, that I had been a little too haſty in ſo freely laying my ſelf open in the Point relating to the Deficiency of the Sluice they were about to place, and what was proper to be done for the Diſcharge of the Back-water, whereby they might, as I thought, eaſily have taken the Hint, and have gone a great way in becoming Maſters of it: for ſince I believed that they muſt one day be obliged to begin the Work again wholly in a new Method, and in a new Place, I thought it not at all reaſonable for me (who had made this the peculiar Buſineſs and Study of the beſt part of my Life) to explain myſelf any further without a valuable Conſideration for it.

The Method which I found they had from the beginning deſigned, and gone on in the Labour of ſeveral Years, to ſtop the Breach, was (at Letter C, in the Draught, or Plan, prefixed) firſt by the carrying out of Piles, or drift Work, from the Sides, until the Paſſage of the Water, running in and out of the Breach, became contracted and ſtraitned; and then, for the filling up of the remaining Space that was left, they contrived the ſinking of Ships and other Machines, and with

a great Number of Hands, for that purpoſe, threw in great Maands, or Baskets, filled with Chalk, and large Bags filled with Earth and Ballaſt, *&c.* which Baskets, with great Quantities of looſe Chalk, Bundles of Hay, and other Matter, were to fill up the Interſtices between the Ships and Machines which they had ſunk; whereby they propos'd to themſelves to cloſe the Breach at once, and to give the Water ſuch a conſiderable Stop, to a good height above the Low-Water Mark, in the time of the neap Tides, that they might be able to get above, and overcome the Force of the Water, before the Springs came on.

The Land-Owners had that Intereſt, that all the Neighbouring Country came in to aſſiſt them on theſe Occaſions, and it was common for Men to ſtand in great Numbers Day and Night, upon every Reflux of the Tide, up to the middle in Water, not without the Loſs of many of their Lives in the Run of the Stream in theſe Attempts; for there being no Sluice at all fixed, that was of any Service or Uſe for the diſcharge of the Back-water for laying the Work dry, there was, at the time of the loweſt Ebb, never leſs than two or three foot depth of Water conſtantly ſetting with a Fall over the Works from out of the Breach, whenever any Degree of a Stop above the Low-water was made.

They ſeveral times, by theſe Methods, and by indefatigable Application, thus brought their Works near to a Stop (they, or Perſons employ'd under them) and ſtill found themſelves unhappy

py in the Succeſs, for when the Paſſage was contracted, and the Water came to be penn'd up to any difference of Level, it penetrated with ſuch Violence either underneath the Bottom of the Ships and Machines that were ſunk, or on the Sides of the Breach, that it ſoon bored its own way, and drove all before it again, with ſuch force, that it is not eaſy to be conceiv'd nor deſcrib'd: I have been told by one of the Gentlemen, who was concern'd in the Work, that when they had, with two other Ships, ſunk the the *Lin* Man of War, the next Ebb there was not a piece of her to be ſeen, and three Days after there was upwards of fifty Foot depth at low Water, where ſhe was ſunk. Another Gentleman concern'd (ſince, my late ſtopping the Breach) ſpeaking of what had paſs'd with them in their Attempts, merrily told me, that at one of thoſe times when they had made a Shut, (or attempted to do it) by the ſinking among other things, a large Cheſt or Machine, upwards of Eighty Foot long, the next Day afterwards, the violence of the back Water ſetting out of the levels upon the Tide of Ebb, worked ſo ſtrong underneath the bottom of this Machine, that ſhe bolted up at once above Water, and diſcharging as ſhe roſe moſt part of the Chalk and Stones, with which ſhe had been ſunk, drove directly with the Current out of the Mouth of the Breach, whereat a Gentleman ſtanding by, who was a conſiderable Land-Owner, and had been at great Expence in the Work, being much

ſurpriz'd, ran along upon the Wall (or Bank) on the ſide of the Breach, and with great earneſtneſs called out, ſtop him, ſtop him, Oh ſtop him! But it ſeems this Gentleman was no Seaman, for if he had, he would have conſider'd that ſuch a Machine being ſunk, takes ſo great hold in the Water when once it is a drift, that it is a very hard thing to ſtop, or Ride the ſame, in a common Streams way, much leſs was it practicable in the Current of the Breach; this Machine driving directly down the River, and ſometimes ſtriking againſt the bottom, and ſometimes rebounding above the Water again, when it came down in View of the Ships at GRAVESEND, they were Alarm'd at the unuſualneſs of the ſight, (as it Emerg'd out of the Water ſometimes with, and ſometimes athwart the Tide) and as they Rid pretty numerous there at that time, they were forc'd to ſheer ſome one way, and ſome another, to avoid receiving any miſchief from it. It drove from thence as far as the *Buoy* of the *Nore*, and there run aground upon a Sand.

THE penetrating of the Water either ſometimes with greater force underneath the Ships, and Machines which were ſunk, and ſometimes on the Sides of the Breach tearing the ſame wider like a new Canal, made them greatly complain of Moorlog, and Quick-ſand, ſaying, that they could eaſily ſtop the Water, but they could not ſtop the Ground which conſtantly run away from them, whereas the only true way to ſtop the Water was, firſt to have ſecur'd the ground: For by the ſinking of Ships and Veſſels, let the Ground be

be ever ſo good, the Water will bore underneath in ſome place or other, and it was a thing utterly impracticable for them to make the Dam tight wherever Ships or other Machines were once ſunk; and therefore when the Gentleman, who brought me down, with ſuch other Perſons concern'd whom I found at the Breach, preſs'd me to give them my Opinion and Advice what they ſhould do, I told them, that it was not in my power to give them any poſſible Aſſiſtance to be depended upon for effecting the Work, in the Place and Method which they had ſo far gone on with already; and that ſince they had ſpent ſo great Sums of Money, and brought their Works ſo near for the making of the Shut, as they then hoped for, I believ'd they would not willingly be perſuaded to quit it, and to reſolve upon raiſing a new and conſiderable Sum to begin the Work again quite in another Method, and in another Place, without trying the utmoſt, in the Method they were upon. I added further, (as they preſs'd me to it) that it was poſſible they might make a Stop in the way they follow'd, and raiſe up a Dam by the mere Strength of Labour and Application; but that I did not conceive how it was probable ſuch kind of Work could be of any long Duration, not only for the Reaſons above ſet forth, but alſo, that the main Body, or chief Matter, of which the Dam was compos'd, being only Chalk, the Water would every where ſearch and find its way thro it, and muſt, upon the Preſſure of any high Tide, en-

danger the ſame being thereby alone deſtroy'd, tho there were no Ships at all ſunk, or Timber-Work in the Foundation of the Dam to lead the Penetration of the Water.

They had before my coming to *England*, ſunk ſome Ships with other Machines, and they had then again prepared Matters ready for the ſinking of two more, which they proceeded to do about fourteen Days after I went firſt down; but miſcarried in the Attempt of their making their ſtop to the low Water, as they had done at other times.

Soon after this, I was, upon the Recommendation of Sir *Alexander Cairnes*, ſent for over to the City of *Dublin*, upon a Propoſition of mine for the making of a better Depth of Water going over the Barr. Which although it does not immediately relate to what I intended chiefly to give an Account of in this Treatiſe; yet being ſome Account how I ſpent my Time, whilſt the Gentlemen were purſuing their foremention'd Attempts at *Daggenham*; and the Buſineſs I propos'd the doing of at *Dublin*, being perhaps what may not be unacceptable to the Curious, and a thing tending to the publick Good, not with regard to the Welfare of that City only, but in ſome degree to the mutual Benefit of both Kingdoms: I will therefore here lay down an Abſtract of the reſpective Inconveniencies which diſtreſs that Port, and the Propoſitions which I made after my Arrival, for the proper Remedy of each.

The

The firſt conſiderable Inconveniency to the Port is, that at the Entrance or coming in over the Barr, there is ordinarily not above Seven Foot Depth at the Time of low Water; and the Tide not uſually flowing there above Eight or Nine Foot, it makes at the top of High Water but about Fifteen or Sixteen Foot at Spring Tides, and at Neap Tides not ſo much; ſo that no Ship of any Burthen, eſpecially if there be any Rowl of the Sea beating over the Barr, can venture to run in without a very good Calculation of the Time of High Water, but when they come near upon the Coaſt, let the Violence of the Weather, and Neceſſity be ever ſo great, muſt wait till the Tides are riſen; and if they happen to miſs in their Calculation of the Depth, the Ships and Mens Lives are in Danger, and have been known to ſuffer thereby.

Secondly, As for ſuch Cruiſing Ships which ſometimes put into this Port, or other Ships of any Burthen, they have no other Place of Safety where there is Depth of Water to Anchor in after they are over the Barr; but in *Pool-begg*, which is an open Roadſtead, at time of high Water, or from the half Flood to the half Ebb, with but very little ſpace for any conſiderable number of Ships to ride in, clear of each other in time of bad Weather: And when it blows hard from the Sea, the Waves beat in upon them over the Sand call'd the *South-Bull*, and if their Anchor ſtarts, they have not above half a Cable's length drift before they come upon the Shore or Sand

call'd the *North-Bull*; ſo that it is conſtantly practis'd in this Roadſtead (more than ever I have obſerved before) for Ships, Men of War as well as Merchant-men, whether fair Weather or foul, eſpecially in the Winter-Seaſon, as ſoon as ever they are over the Bar, to veer their Sheet-Anchor to the Ground, and to ride with their Yards and Top-maſts down; and notwithſtanding ſuch Precaution, are not without Inſtances of being ſometimes driven upon the aforeſaid Sand, either by their own Anchors ſtarting, or the next Ships to them; which is not only unſafe and incommodious to ſuch cruiſing Ships of the Royal Navy, who are appointed, in time of War, to have their Station in the Narrow Seas, between *England* and *Ireland*, and are oblig'd ſometimes to put into this Port, but alſo is diſadvantageous and diſcouraging to Merchant-Ships of any Burthen; particularly ſuch from *Great Britain*, who touch at this Port for taking in Goods, in their way to the *Mediterranean*, and other Voyages.

Thirdly, None but ſmall Veſſels of about Eight or Nine Foot draught of Water, can at ordinary Tides go up to the City, taking the top of high Water for it; and the Tide, every Ebb, conſtantly falls away from them, where they lie at the Keas of the City, leaving them for the moſt part dry on the Ground at low Water. And for ſuch other Veſſels or Ships, which cannot (eſpecially at neap Tides) go and come from the Town with their Lading, and are oblig'd to ride

below

below *Rings-End*, as far as *Salmon Pool*, the Water likewiſe Ebbs for the moſt part away from them, and at ſuch time that any Swell ſets in from the Sea, which they lie openly expos'd to every Tide, at their firſt beginning to float, and again upon the Ebb, when the Water falls and they firſt begin to touch the Ground, they ſtrike and thump with their Keels, untill the Tide is more Ebb'd away from them, ſometimes beating their Bottoms out in the very Places where they are oblig'd to lie to lade and unlade their Goods; ſo that by reaſon of theſe Inconveniencies, it is remarkable that for the particular Trade, of this City, (as to the Carriage of Coals, *&c.*) they are oblig'd to build ſmall Ships and Veſſels of Strength like Lighters, on purpoſe for lying on the Ground with their Burthens.

How very diſadvantageous theſe Inconveniencies muſt be to the Trade of that Port is eaſie to be conſider'd by Perſons who underſtand any thing of Sea Affairs, and need not be further renumerated by me.

The Remedies which I propos'd to the City, for each reſpectively, were as follows;

First, That I was ready to demonſtrate and explain an effectual Method for the making four Foot better depth of Water coming over the Barr, to be perform'd in ſuch manner (not hitherto practis'd,) that when once fix'd, the ſame ſhould remain and continue at leaſt to the ſame depth with very ſmall Trouble and Expence to a long duration of Time, and to be practicable

by the ſetting of proper Marks for Ships to run in and out of the Port, with any leading Gale of Wind, as well by Night as by Day.

SECONDLY, For the better Safety and Comodiouſneſs of ſuch Ships which are oblig'd to Ride in *Pool-begg*, or other mention'd places below *Rings-end*, to run a low ſnug Wharf, or peer of Drift-work the whole way from the outermoſt point of the *South-bull*, to the main Land at the place called *Iriſh-Town*, which I was willing to make a Pattern for the Method of doing it, and to leave the City, if they thought fit to carry on the ſame at their leiſure, being a thing eaſy to be done by any other Perſon, but requiring more time than I was willing to ſpare upon it; which work I am inform'd they have ſince taken in hand of themſelves to do.

THIRDLY, I propos'd the placing down a Sluice of Stone to ſome Feet depth below the low Water Mark, and to run a ſtrong dam acroſs, from the point of *Rings-End*, to the Highland called *Molands Buildings*, by which to pen up the Water in a Baſon large enough to entertain two Hundred Sail of Ships, to run directly in and out at the time of high Water, to lie always afloat, to lade and unlade their Goods, with Expedition and Safety, at the Keas of the City, to be practis'd by the keeping up the Water always in the Baſon, as high or rather ſomething higher than the height of the ſpring Tides, and by the fixing of the Apron of the Sluice to the depth as before obſerv'd.

WHICH two ſeparate Works of fixing a better depth in the Barr, and making a Baſon, I propos'd in my Report, upon making my Survey, to undertake the Performance of in three or Four Years at fartheſt, the Sum to be expended on the Work, I eſtimated not to exceed twenty thouſand Pounds; And the Conſideration of a Reward to my ſelf, to be ſettled and agreed to after having demonſtrated what I ſhould propoſe, and the ſame ſhould be approv'd of by the City, to be taken in hand: having made it my Conditions upon my going over from *London*, that before I proceeded to explain particularly how and after what manner, I deſign'd the Practice in the reſpective Methods of carrying on the ſaid Works, that there ſhould be ſuch Perſons whom the City ſhould think fit, choſen and Commiſſion'd to hear and examine the ſame, and that a ſatisfactory Caution ſhould be firſt given me, that when I had produc'd the particular draught and Deſcription of what I ſhould propoſe to be undertaken, no other Perſon ſhould afterwards be employ'd in the Performance of it without my Conſent, or the paying me a certain Sum of Money.

THESE things were what I laid down to be perform'd, and the Conditions on which I propos'd to proceed. But ſoon after my Arrival before I had gone thro' with the neceſſary Obſervations to enable me to make my Report of what I found practicable, the time came on for the Election of Mayor and Sheriffs, and ſome diſputes

putes and Differences ariſing, which were near twelve Months afterwards before they were ended, and no Mayor for that time ſettled, nor Buſineſs of Conſideration Tranſacted; I was thereupon inform'd by the Committee of Aldermen and Common Council of the City, who were appointed to treat with me at my firſt coming over, that their Power extended no further than to aſſiſt me with what I demanded for the making of my Survey, and to receive my Report, which they intended to recommend heartily to the City for their coming into the Meaſures I propos'd for my Encouragement.

But that the Office of Mayor being vacant, they could not Tranſact any thing with me until a general Court could be legally Aſſembled, that they were very willing to anſwer the demand of my Charges to be born me, and conſideration for my Time, and did hope from the Repreſentations and Petitions which were ſent over to *England*, that the Affairs of the City would ſoon be ſettled, and ſuch a Court Conven'd; therefore perſwaded me from time to time to a Continuance there, which I comply'd with for upwards of eight Months.

In about three Months after my coming to that place I had advice from *London*, that the Breach at *Daggenham* was ſtop'd by thoſe Gentlemen whom I left upon it, one principal means of their accompliſhing of which was, by the drift of a Row of large Piles, drove near to each other, both within and without the Ships which were

ſunk,

ſunk, and then throwing in large Maands, or Baskets, filled with Chalk as before mention'd. But it proved, that by means of the Cavities in the Chalk, *&c.* there was ſuch a conſtant Courſe of Water which run underneath and almoſt every where through the Works, that the Water within the Levels on the inſide of the Dam, after the Breach was ſtop'd, Ebb'd and Flow'd every Tide, the height of three or four Foot right up and down, and thereby ſo gull'd and cauſed the Dam Inceſſantly to ſettle downwards, that it put the Perſons concern'd upon making Application, and they had a Power granted them, to Impreſs any Chalk Veſſels, *&c.* that paſs'd on the River, which might be uſeful to aſſiſt them in that Work; on which occaſion, it is reported, that the making of Lime, and the Buildings about *London*, was for a while in ſome meaſure Retarded. By Power of this Commiſſion they were enabled to throw in Ten or Fifteen Freights of Chalk a Day at the Breach, to the Succour of the Works but notwithſtanding it was obſerv'd in ſeveral places, that where they threw in very large quantities of Chalk one Day, they found the depth again as deep as it was before the next; until not long after, its being thus continued to be maintain'd, the publick News Papers became full with the Account, that the Works were wholly deſtroyed upon the riſe of a great Tide which happen'd, and the Breach torn down to a prodigious depth.

AFTER theſe misfortunes in which had been expended more than the value of the Levels, by the Reiterated Labour of about Seven Years, and the Land-Owners ſaw no view or hopes by all the Endeavours which they had uſed, of the Works ever being brought to any good Effect, whereby they became wholly diſcourag'd in the uniting to raiſe any further Sum, and deemed their Lands to be loſt; The apprehenſions of the growing Miſchief to the Navagation of the River, began then to take place in the Minds of Men, and in the Month of *April* 1714. a Bill by the Honourable Houſe of Commons, was order'd to be brought in, for undertaking the ſtopping of the Breach at the Expence of the Publick.

HEREUPON, believing it might be proper for me to make ſome Propoſal of my Endeavours in the Undertaking of this Service, I reſolv'd not to wait any longer in *Dublin*, but deſir'd that my Propoſitions which I had made to that City, might be taken into conſideration at ſome other time, and came over for *England*. My Intention was upon my coming over, to have laid ſome Propoſal directly before the Parliament, relating thereto; but upon my arrival being inform'd there was a Bill already prepar'd by the Committee appointed, and that a certain Number of Truſtees, would be therein nominated to ſee ſuch Act that ſhould be made, put in due Execution. I did not make any Propoſal till the Act took Place.

ACCORDINGLY, in the Month of *Auguſt* 1714. the Truſtees met at *Guild-hall*, of which the Right Honourable the Lord Mayor of the City of *London*, the Recorder and Aldermen for time being, were firſt nam'd in this Act, together with a great many other Perſons of Diſtinction and Honour. At this their meeting they made Publication in the *Gazette*, of a Day appointed for the hearing of all ſuch Propoſals that ſhould be made to them, for the undertaking the ſtopping the Breach.

THE firſt Propoſals which were, conforming to ſuch Advertiſement, by any Perſon made or brought to the Truſtees, was alone for the bare ſtopping of the Breach. Amongſt ſeveral other Perſons Mr. *Boſwell* (whom the Truſtees afterwards concluded a Contract with,) made his firſt Propoſal for ſtopping of the main Breach only, for the Sum of nineteen Thouſand Pounds. But the Truſtees at this their Meeting came to a Reſolution, that two Additional Articles ſhould be Advertis'd in the *Gazette*, to be perform'd beſides the ſtopping up of the Breach. Namely, the removing the Shelf that had been thrown out in the *Thames*, and lodg'd near the Mouth of the Breach. And next the making good the Walls of the Levels, extending from the Point of Land above the half way Tree, down to the Mouth of *Raynham* Creek.

I attended at this Second meeting of the Truſtees, and made my Propoſal to them for performing

forming of the ſaid reſpective Articles, for the Sum of Twenty four Thouſand Pounds.

BUT Mr. *Boſwell*, who had before made his Demand for the Sum of Nineteen Thouſand Pounds, notwithſtanding the ſaid two Additional Articles, appointed by the Truſtees, brought in his Second Propoſal, for the accompliſhing of the whole Work for the Sum of Sixteen Thouſand five Hundred Pounds, and to be compleated wholly at his own Riſque, and to begin with his own Money.

THE Truſtees hereupon thinking him to be the faireſt Propoſer, that would engage himſelf for the leaſt Sum, and rather more at his own Riſque, than any other Perſon propos'd to *do*; They very readily came into the Reſolution to Contract with him, without taking upon them to examine, whether his Skill was equal to his Propoſal, or was able to go through with the Work or not, as apprehending themſelves not to be proper Judges in ſo difficult and Precarious a Work; which occaſion'd my aforeſaid Propoſal which was for ſo much a larger Sum than Mr. *Boſwell* had offer'd, to be therefore entirely rejected, and he went on with his Undertaking, having made it ſure that no Man elſe would go below him.

AS it now comes in the proper Place, I ſhall go on as near as I can to give the Reader a very ſhort, but juſt Account, of the Scheme and Method he deſign'd and laid down for the Perform-

ance

ance of his Work, and wherein he had the Unhappineſs afterwards to miſcarry, and to render the Breach much more Chargeable and Impracticable to be ſtop'd than when he began it.

THE Method which he intended firſt to make uſe of, in the Stopping of the Breach, was by ſix large Ponts or Cheſts, of ſixty Foot length, thirty Foot Breadth, and twenty Depth, flat at the bottom, and pointing away ſharp at each end, like the Sterlings of *London Bridge*. Theſe Machines he propos'd to ſink at about twelve Foot ſpace from each other, beginning from a Peer, to be carry'd out on each ſide of the Breach, conformable to the Shape of the ſides of the Ponts, which Peers were firſt to be built, and the bottom of the Breach to be made Level for the ſinking of the ſaid Machines, and when they were ſunk at the diſtance aforeſaid regular by the ſide of each other, then the Spaces between them were deſign'd to be fill'd up by Piles and Drift-Work. In the upper part of theſe Machines, there was intended draw-ſluices to be made, which were to ſtand open, until the reſpective Spaces between the ſaid Cheſts were to be likewiſe filled up, and then the Sluices made in the Machines were all to be ſhut down, and ſo at once to ſtop the Water out of the Breach. This is the ſhort of what I have been inform'd he firſt laid down his Scheme for, and did intend to put in Practice: But after he had, by the carrying out of his ſaid Peers a little way from each ſide of the Breach, thereby contracted the Paſſage of the Water going in and out,

out, it began ſoon to move with the greater Force, and work'd away the Ground in the bottom of the Breach, in ſuch manner, that he found it would never be practicable to make, or maintain the Foundation level, for the ſinking his Machines, or the keeping them upright in their Places, to any regular Order or Form.

THEREFORE he quite laid aſide his Intention of having the aforeſaid Number of Cheſts built, (for which he had fram'd the Bottoms in a Yard by *Vauxhall* Bridge) and reſolv'd to have but two Cheſts made, and afterwards laid aſide his Thoughts of two, and reſolv'd but upon one only, which was finiſh'd in a Dock at *Blackwall*, and inſtead of a greater Number of ſuch Cheſts, to carry on his Work to a narrower ſpace, with Piles, *&c.* But as he went on with the driving of ſuch Piles, and fitting and ſquaring of Matters to them, as he drove them, he found the Ground to be ſtill more violently torn and driven away from him, to a very great depth; he therefore then entirely chang'd his Scheme, with relation to his Cheſts, and came to a determin'd Reſolution to make uſe of the Method of the ſinking of Ships, as had been before done by the Land Owners; for which Purpoſe, he Projected at firſt, the Sinking of one Ship only, and conforming to which Deſign, he drove out Piles from each ſide of the Breach, until he came to meet in the middle, within about 30 Foot, which was the breadth of the *Abingdon*, a Ship which he had got ready to ſink, intending to cloſe and fill

up

up his Works to ſome little heighth above the low Water Mark, by throwing in Chalk and Hay, *&c.* when ſuch Ship ſhould be ſunk, alſo he provided a great Number of large ſtrong Hair-baggs, ſome of which were near thirty Foot in length, which he Rafted and bound by Cords together, to ſink underneath the bottom of the Ship, for her to ſit upon and bed her ſelf into, as well as others of leſs Dimentions, in Order to fill up the Interſtices or Spaces, between the Ship and the Peers or Jetties, and for the keeping and ſecuring the Chalk, from being waſh'd or carried out of the Jetties; by the force of the Water, he ſunk large Sheets of Boards, down by the Sides of the Piles to the bottom of the Breach: But whilſt he was thus bringing out his ſaid Jetties, and preparing his intended Matters in one neap, for the ſinking of his Ship in the next, the Operation of the Spring Tides (which Alternately happen every Fortnight, or little more) gull'd and tore the Chalk out of his Jetties, broke down and carried away the Piles, to a greater width, and made the Foundation into which they were drove conſiderably deeper than it was before, which after he had thus made tryal two or three Times, and found the Miſchief which was done gain'd upon him, ſo that the damage which happen'd in the time of the Spring Tides, ſtill grew to be more than he could make good again in the neaps, he then reſolv'd to ſquare and compleat his Jetties, or Peers, for the making the ſaid Space in the middle of his Works, to the breadth

of Sixty Foot only, and to ſink two Ships inſtead of one. Accordingly when he had prepar'd Matters in readineſs as before deſcribed, and purchaſed a Second Ship, he proceeded on and ſunk them both together, in the ſaid Space at the Time, of the neap Tides. As alſo for the more effectual making of his intended ſtop to the low Water Mark, he ſunk at the ſame time, a ſmall Veſſel between, and at each Quarter of each Ship, both on the outſide of his Works towards the *Thames*, and on the inſide towards the Levels; amongſt which was the forementionʼd Pontoon built at *Blackwall*; which Machine and ſmaller Veſſels, were thus ſunk at the end of the Ships, the better to back and ſupport the Chalk, Hay, Baggs of Earth, *&c.* which was prepar'd both in a Magazine on each ſide of the Breach, and put into a great Number of Veſſels which lay ready above and below the Works for that pupoſe, and was accordingly thrown in with the greateſt Application that was poſſible, at the ſame time when the Ships were ſunk, or ſome of it the Tide or two after. Thus he, with his utmoſt Endeavours, proceeded in hopes to have made ſuch a ſtop to the low Water in the time of the neap, that he might have been able to have rais'd and ſecur'd his Works to a much greater height before the Springs came to take Power.

BUT the Water finding its paſſage the very firſt Tide after the Ships were ſunk, began to Operate with ſuch Force underneath the bottoms of them, and the other Veſſels, as well as amongſt the

Piles, and Drift-work on each ſide of them, that the Chalk and other Matters which had been fill'd and thrown in, was torn and driven away; and the ground with it to ſuch a depth, that both of the ſaid Ships with part of one of the Jetties, ſettled right down near two Fathoms, and the Second Day after the Attempt was made, one of the Veſſels which had been ſunk on the outſide of the Ships, next the *Thames*, (laden with Chalk, and Rubbiſh,) was thrown up and caſt upon the Bank on the inſide of the Ships to above Sixty Yards diſtance from the Works, and the foreſaid Machine built at *Blackwall*, roſe up from the Ground, broke and tore to pieces; the Water, when once but a little pent, being of that forcible Power, that wherever it gets the leaſt Paſſage, eſpecially where the Ground is bad, it ſoon makes its own way until it comes to move more upon a Level and with more eaſe; of which I ſhall have occaſion to ſpeak more hereafter.

THERE is another thing proper to be taken notice of in this place, relating to Mr. *Boſwell*'s Flood-gates or Sluices, (as they have been term'd) fix'd in Cutts, which he made in the Walls or Banks of the Levels to the Eaſtward of *Daggenham* Jettie, made only with Gates deſign'd to open outwards, but not with proper draw Doors to pen the Water either in or out of the Levels to any height required, as I have ſince made my Sluices, and was abſolutely neceſſary (in my opinion) to facilitate any Method whatſoever for ſtopping the Breach. He had two of theſe Sluices

which he had placed upon the Land, with their Aprons about thirteen Foot perpendicular height above the low Water Mark, without any Canals cut to them through the Marſh Land, by which Scituation they could not poſſibly be of any Service to him, in the laying his Works dry, at the height which he carried on his intended ſtop at low Water, had there been a hundred of them; the ſaid height which he carried on in his Works, being near Eight Foot below the Marſh Ground, nor could they afterwards, had he ſucceeded in his ſaid Attempt, have been of any uſe in giving eaſe to the Water running over his Works, any longer than the firſt Quarter, or firſt third Ebb, when the Water either run out with but a very thin Body, or not at all over the Aprons of his Sluices, and the Current ſet with the greateſt force out of the Breach. Again, upon the firſt part of the Flood, when the Tide uſually riſes the quickeſt, his Sluices could be of no uſe, in ſaving the fall and force of the Current ſetting in over his Works, (as he carried them on) until the Water came to riſe above the height of the Marſh Land, and to ſet in with ſome depth upon the Aprons of his Sluices. And they were not at all made practicable to be ſhut near the time of high Water, to keep out the long ſlack at the laſt part of the Flood, and firſt pinch of the Ebb, which was very proper to have been done.

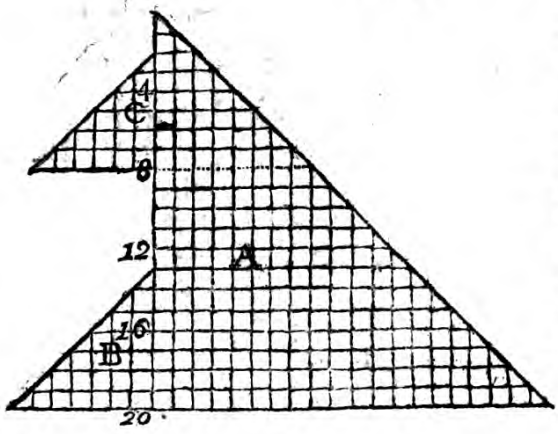
And beſides they were not only thus injudiciouſly fix'd, with reſpect to their Scituation, but ſo very ſlight and defectively built, that when he

grew

grew near the making his ſaid Attempt for ſtopping at low Water, and order'd his Gates then to be ſhut, to keep the Flood Tide from having its paſſage that way, that there might be leſs Power of the Backwater ſetting out over his Works on the Tide of Ebb, tho' the Breach ſtill remain'd open, and the Water flow'd on the Inſide as well as on the Outſide of the Levels, and could not, at the height of the Tide, (at which Time the Water had its greateſt Weight) be above twenty Inches, or at moſt two Foot difference of Level. Yet the Water found its Paſſage underneath his Sluices, and after he gave over his Undertaking, tho' his Gates were then ſet open, and ſome of them unhing'd and gone, before I enter'd upon the Spot, the common flux and reflux of the Tide, gull'd and tore away the Earth to ſeveral Foot breadth on the backſide, or behind the Wharfs of his Sluices, and the Apron of one of them was blown up and thrown into the Levels, within a few Months after I began my Undertaking, without any other Preſſure of Water than before ſhown; ſo that had his Sluices been fix'd to the depth that was neceſſary, and with draw Doors, in a proper manner made to them, in my Opinion, they could not have endur'd the twentieth part of the Weight that was to come againſt them, if he had ſtop'd the Breach; and this Maxim is always to obſerv'd in Caſes of Workmanſhip, (relating to the Power of Water,) that whatſoever comes ſhort of its due Strength, is infinitely ſo.

By reaſon of the Deficiency of his ſaid Sluices, and that the Paſſages, or Cutts, which he made for them in the Walls, whilſt they ſtood open, admitted more Water into the Levels upon the Tide of Flood, than was diſcharg'd by the ſame Paſſage upon the Tide of Ebb; it being obſervable, that the firſt part of the Ebb falls away quicker than the laſt part of the Tide riſes, (the common ſtand at high Water included) I therefore was under a Neceſſity to be at the Expence of ſtopping them up, before I proceeded to raiſe my Dam in the Breach, or whilſt I had made the grand ſtop to the Water flowing into the Levels in one place, I muſt inevitably have had two other ſmall Breaches encreaſing upon me, by way of his Cutts.

And that what I have here ſaid may be the better underſtood by Perſons to whom this Matter may be ſomewhat foreign, relating particularly to the Deficiency in the Strength or Workmanſhip of his ſaid Sluices, I will here lay down the Quantity and Nature of the Weight, or preſſure of Water lying againſt any Sluice, Dock-Gates, Dam, or Penn of Water whatſoever. As for Example, Let the Perpendicular Line, repreſented



preſented by the Triangle A, be ſuppos'd to repreſent the height of twenty Foot Water, lying againſt any Gates: And one cubical Foot of brackiſh Water, (ſuch as is here at the Breach) I have experimented, does weigh ſixty four Pounds, or very near it, and the Weight of Water for each ſingle Foot in breadth, lying againſt every Foot in height of any Gates or Sluices, wherever any Penn is made, always preſſing, as is deſcribed by the Hypotheneuſe of the ſaid Triangle A, *viz.* where there is only a Penn of ſix Inches depth of Water, there lies but the Weight of eight Pounds preſſing againſt one Foot in breadth; and againſt one ſingle Foot height of Water being pent up, there will lie but half the Weight of a cubical Foot, or 32 Pounds; and againſt the ſecond Foot height of Water, the Preſſure encreaſing, as repreſented by the Hypotheneuſe of the ſaid Angle, the Weight will be 128 Pounds; and againſt twenty Foot height, 12800 ſingle Pounds, or divided by 112 (Weight Averdupoize) it gives five Tuns, 14 *Ct.* 1 *qr.* 4 *l.* lying againſt every twenty Foot in height, to one ſingle Foot in breadth, and ſo for the whole width of any Sluice or Penn of Water, in whatſoever manner

it be made: As for inſtance, I have, on Spring-Tides, often had upwards of 20 Foot Water lying againſt my Sluices from the *Thames* ſide, ſince the time of the Breach being firſt ſtopped, and one of them being 36 Foot in breadth, the ſame computed at only 20 Foot height, makes 205 Tons, 14 *Ct.* 1 *qr.* 4 *l.* Preſſure of Water lying againſt one of my Sluices; but again there being about 7 Foot depth of Water upon the Apron of the Sluice, remaining pent up in the Levels, the ſame is (or was before the time of my Dam's being made in my Canals) a Counter-Preſſure of 7 Foot in depth, deſcribed by the Angle B, which computed by multiplying the ſaid 7 Foot by half the ſaid depth, and again by 64, (the Weight of a cubical Foot of Water) and then by 36, the breadth of the Sluice, and dividing the ſame by 112, makes 25 Tun, 4 *Ct.* which being ſubſtracted from the Weight which preſſes on the *Thames* ſide, makes 180 Tuns, 10 *Ct.* 1 *qr.* 4 *l.* lying againſt the whole breadth of the Sluice; or being computed for one ſingle Foot in breadth, the Difference of the Preſſure will then be 11232 Pounds, or 5 Tuns, 32 Pounds.

Again, the Aprons of the Sluices which were made by Mr. *Boſwell*, (or Perſons directed by him) being not fixed above eight Foot depth below the Riſe of the uſual Spring-Tides, [illegible] the Breach being, as before obſerv'd, not at all ſtop'd in his time, the Water had an uninterrupted Paſſage into the Levels, and thereby, in ſome degree undeniable, conſtantly flow'd and ſwell'd

on

on the Inſide (of the Walls or Banks) as well as on the Outſide of his Sluices, and the Difference of the Level at high Water, according to my own Obſervations, and the beſt Account I could have of it, did, at Spring-Tides, not exceed the height of two Foot, *viz.* eight Foot on the Outſide of his Gates, as laid down by the prick'd Line drawn in the Triangle A, and ſix Foot on the Inſide, laid down by the Triangle C; ſo that by the Rule aforeſaid, the Preſſure of Water (at 8 Foot depth) lying on the *Thames* ſide againſt his Sluices to a ſingle Foot in breadth, amounts to 2048 *l.* or 18 *Ct.* 1 *qr.* 4 *l.* Averdupoize Weight, and ſubſtracting therefrom the Counter-Weight on the Inſide, deſcribed by the Triangle C, reckon'd at ſix Foot depth, according to the Difference of Level before taken notice of, and at a ſingle Foot breadth (containing 1152 *l.*) there will remain only 896 *l.* or 8 *Ct.* Averdupoize; and yet this ſmall Preſſure of Water before deſcribed, made its Paſſage both underneath and on the ſides of his Sluices, as has been evident to every one that has ſeen them, when the Water has been either going off, or coming on upon the Aprons.

I have been the more particular in this Explanation, becauſe ſome hard Cenſures have been imputed to me, as if my engaging in the Work out of his Hands (as it has been call'd) had been injurious to him, or that he only wanted Time and Money to have enabled him to accompliſh his Undertaking; whereas, by the Methods he pro-

proceeded in, I believe, had he had all the Time and Money in the World, no part of his Work could ever have been effectual; as by the Principles laid down in the Deſcription of my Method, the Reaſons for my Opinion will, in the following Pages, more plainly appear.

Soon after his forementionʼd Miſcarriage, in ſtopping to Low-water Mark, he gave over working any more at the Breach, and the time, for which he had enterʼd into his Contract, being elapsʼd, the Truſtees met, and appointed a Committee to go down and view the State of his Works; a Copy of the Report which they gave thereof, is as follows.

To the Honourable the Truſtees, *appointed by Act of Parliament for the ſtopping of* Daggenham-Breach, *&c.*

IN obedience to an Order of the ſaid Truſtees of the 4th inſtant, We whoſe Names are ſubſcribed, have met, and taken a View of the State and Condition of the Works now ſtanding at the ſaid Breach, ſet up by Mr. *William Boſwell* the Undertaker, and continued there upon the ſaid Works from half Ebb till Flood; and upon Low-water we went in a Boat, and found the ſeveral Depths of Water to be as follows, *viz.*

ON

ON the Weſt ſide 20 Foot below the Works to the South, 40 Foot deep. On the South ſide of the Work 20 Foot from the Stern of the *Abingdon* (one of the Ships ſunk in the ſaid Breach) 30 Foot deep On the ſame South ſide of the Works 15 Foot from the Stern of the *Recovery*, (another Ship ſunk in the ſaid Breach) 18 Foot deep. On the South ſide of the Piles, ſtanding on the Eaſt ſide of the ſaid Breach 10 Foot from the ſaid Piles, 18 Foot deep.

BETWEEN the ſaid Ships and the Piles ſet on the Weſt ſide of the ſaid Breach 29 Foot deep. Betwixt the Works to the Northward near the Piles on the Eaſt ſide 24 Foot deep. At the End of the ſaid Piles on the Eaſt ſide 19 Foot deep. Fifty Foot diſtance North from the ſaid Piles 31 Foot deep. Fifty Foot further North 50 Foot deep.

FROM the Piles on the Weſt ſide 25 Foot, North 26 Foot deep. Fifteen Foot North from the ſaid Piles on the Weſt ſide 14 Foot deep. Cloſe to the ſaid Piles on the Weſt ſide 20 Foot deep.

COMING about the Piles to the Southward, we find theſe Depths following, *viz.* 29, 24, and 18 Foot deep.

WE find that all the Works made by the ſaid Mr. *Boſwell* upon the ſaid Ships (before they were by him ſunk as aforeſaid) are either broken or cut away; And the Weſtermoſt of the ſaid two Ships is entirely under Water, except ſome few of her top Timbers at the Stern, about a Foot

above

above Water, and the other Ship ſunk on the Eaſtermoſt ſide, lies with her Head in deep Water out of ſight, and her Stern twiſted in ſinking and very much ſhatter'd; one part of her Larboard Quarter lying about eight Foot above Water, which with the Condition of the Piles on both ſides the ſaid two Ships, ſome being broken and carried away, and others being looſe and may go away the next Spring Tides, and the depth of Water between the Ships and the Piles on both ſides, to which add the Conſideration of the depth of Water on the Watermoſt ſide below the Works, and the ſhatter'd Condition that the Works do there appear to be in, as well as on the Eaſtermoſt part of the Works on both ſides, where, upon the ſinking the ſaid Ships, the *Piles*, together with the Hurdles and Chalk, blew up and waſhed away: We humbly conceive, that it will be impoſſible for the ſaid Mr. *Boſwell* to make any ſecure and regular Foundation upon the ſaid Ships, as they now lie; And we believe that the ſaid Ships will not remove away, but that the moſt part of the Front Piles next the ſaid Ships, may be carried away by the next Spring Tides, which we are well ſatisfied muſt be the Conſequence from the great depth of Water between the ſaid Ships and the Piles, as well as on the North and South ſide of the ſaid Piles, both on the Eaſt and Weſt ſide of the ſaid Ships

WE are further of Opinion, That if the ſaid Mr. *Boſwell* had ſucceeded in the ſinking his Ships, as he could have wiſh'd, yet that his

Works

Works in general were not ſtrong enough to withſtand ſo great a weight of Water. All which we humbly ſubmit to the better Judgment of the ſaid Truſtees. Dated this 7th Day of *November*, 1715.

John Ward,
Tho. Pannwell,
John Mayhew,
Tho. Tatam,
William Johnſon,
William Coteſworth,
John Auſten,
John Hazelwood,
John Merry.

The Truſtees, after they had received this Report, and given Mr. *Boſwell* one or more Hearings, with relation to what he could further offer, without his giving them (as is preſum'd) any Satisfaction: They appointed a Day, to be adverti ſed in the *Gazette*, for their Meeting, to receive new Propoſals from whomſoever ſhould offer the undertaking for the ſtopping of the Breach; and about fourteen Days time, as I remember, was given for this purpoſe.

Upon which Mr. *Boſwell*, Mr. *Ludgate*, and at leaſt four or five more, attended with their Models and Propoſitions; ſome offering to ſuffer Death if they did not do it, ſome to be employ'd under the Commiſſioners, and two of the Propoſers offered to give Security, one of which was for doing the Work for 35000 Pounds; and amongſt thoſe, who propoſed Security, I offered to undertake the Work for 27000 Pounds; but that if the Truſtees would be pleaſed to appoint

my

my Scheme, or Method, to be examined, and would give me a Caution of 5000 Pounds, that after I ſhould explain and lay down a proper Method to them, no other Perſon ſhould be employ'd to make uſe of the ſame, in the ſtopping of the Breach without my Conſent; and that, in caſe of their Approbation, after ſuch Diſcovery to be made, they would then pleaſe to take my ſingle Bond for the Work to be done at the publick Riſque, without my procuring Friends to be engaged in it, I was ready to undertake it for a much leſs Sum. But the Truſtees, upon their receiving of this and the other Propoſals which came before them, were ſo very far from coming into what was offered by me, that they made a new Order, that whoſoever would undertake the Performance of the Work, ſhould not only find Security for the Repayment of all ſuch Money which ſhould be received from the Truſtees, in caſe of the not performing the Work; but alſo be obliged to the further Payment of 10000 Pounds, to anſwer ſuch Damage to the Breach, which any further unſucceſsful Attempts might occaſion; it being certain that it was not practicable to be taken in hand in either of ſuch Places, where the Land-Owners, or Mr. *Boſwell*, who ſucceeded them, had been at work. Whereupon they appointed another Day for the bringing in new Propoſals conformable thereto.

This new Order put me, I muſt confeſs, under ſome Difficulty, to find Friends ready to engage

in

in ſuch a Security, ſo that I was about to have declin'd offering any further Propoſal, and to ſtand ſtill a while, to ſee who would be the next undertaker, but conſidering that the moſt part of thoſe who made Pretenſions to be employ'd were not able, or did not offer any Security at all to the Truſtees. I therefore drew up a Propoſal in which I offer'd to the Truſtees, to undertake the Work for the Sum of 30000 Pounds, and to give them Security for the forfeiting of five thouſand Pounds, over and above all ſuch Money as I ſhould receive from them, in Caſe of my not effecting the Work. And in this propoſal again preſs'd the Conſideration to them, that as I preſum'd the effecting of the Work, with Certainty and Security to the Navigation of the River, was a thing more ſought for by the Truſtees, than the ſtrictneſs of any Terms of Penalty enter'd into by any Undertaker, ſo if they would be pleas'd to appoint a Comittee to Judge and examine the Schemes of the ſeveral Propoſers, I perſwaded my ſelf, I ſhould be able to give them ſuch ſatisfaction of the Certainty of the Performing the Work, that would be more agreeable to them, than any Security whatſoever, and I mention'd, that as by all the Methods which had been practiſed, and Schemes which I had ſeen it was impoſſible to ſtop the Breach, ſo as to be of any long duration, and that every Miſcarriage muſt ſtill make the Breach worſe, and as neither the Perſons who had already practis'd their Endeavours, nor thoſe who made now new Propoſals, did pretend to

offer

offer any Method from any Certainty of their own Experience, ſo if after the Examination of what I ſhould lay before them, there ſhould be any one Gentleman of the Committee to be appointed, that ſhould think any other Propoſition better or equal to mine, I was willing to give Place without more trouble to the Truſtees; but if on the other hand, the Scheme, that I ſhould lay before them ſhould be unanimouſly preferr'd and approved, then I hoped that my Experience of it would be deem'd equal to a greater Security, than any that I had offer'd.

AFTER my delivery of this Propoſal to the Truſtees, they were pleas'd to let me know, that they had reſolved upon appointing a Day to have all Propoſers bring in their Schemes to be *Examin'd*, and that they might the more effectually be enabled to judge and diſtinguiſh what Method ſhould be the moſt probable of carrying with it the deſired Succeſs: They invited to their Aſſiſtance Brigadier *Richards*, Surveyor General of his Majeſty's Ordinance, Mr. *Acworth* Surveyor of the Navy, and Coll. *Armſtrong*, firſt Engineer of *Great-Britain*. Theſe three Gentlemen were accordingly pleas'd to favour the Truſtees with their Company at *Guild-Hall*, on an occaſion ſo much look'd upon tending to the publick Welfare. And after ſeveral other Propoſers had produced their reſpective Schemes, I was called in, and Preſented the following Propoſitions to be examin'd, which being a Method not practiſed in any Country that I have heard of before

before *I* had occaſion to make uſe of it in a Foreign Service, I mean ſo far as relates to the Uſe of Dovetail Piles, which tho' the ſame have been us'd about the King's Docks, yet having not, as I know of, been before apply'd in the making of Dams, and having found it to be the only ſecure way that can be depended upon for the making of large Dams, where there is any Conſiderable Preſſure of Water and the Ground Bad; I will therefore give it a Place in this Treatiſe, for the uſe of thoſe who may in any future Misfortune, in the Banks of the *Thames* or otherwiſe, have any Benefit by it.

THE DESCRIPTION, of a Method for the effectual Repairing of the Breach, in the Levels of *Havering* and *Daggenham*, according to my Propoſal, Humbly offer'd to the Right Honourable the Truſtees, in the Year 1714, and again Renew'd the 29th of *November*, and the 6th of *December*, the Preſent Year 1715.

FOR the better Underſtanding of my intended Method, I ſhall firſt lay down Two general Rules, or Principles, which to Facilitate a Work of this Kind, where there is a great Riſe of Tide and Inlet of Water, is abſolutely neceſſary to be obſerv'd.

FIRST, THAT a ſufficient diſcharge of the back Water, which flows in upon the low Lands and has worn a Creek, with large Branches a great way into the Country, ought to be made by fixing of a ſufficient Sluice, at leaſt down to the depth of the low Water Mark or ſome Feet below it, whereby to eaſe the Force and Fall of the Current, whilſt the needful Work for the ſtopping of the Breach is carried on, which otherwiſe muſt be attended with a very Expenſive waſte of Labour, Time and Materials, and to make the Foundation tight and ſecure, would be utterly Impracticable.

SECONDLY, where a Dam is intended to be made, in a place where the Spring Tides every Twelve Hours, and twenty Four Minutes, uſually flows 22 Foot, and is (as in the Caſe of the preſent Breach) by the unskilful Attempts that have been made, torn and worn down in ſeveral Places, to double that depth below the Surface of low Water Mark, the greater Care ought to be taken to make the Foundation tight and ſecure, that it may not be Poſſible for the Water to penetrate either underneath or on the Sides of the Creek or Place that is to be ſtopped up, for if once the Water finds the leaſt Paſſage, eſpecially at the Foundation where the greateſt Preſſure of Water will always be, and perhaps but very ordinary or bad Ground, there will then be inevitable Danger, that either in the Practice

ctice of carrying on the Work, or afterwards when compleated, upon the Riſe and Preſſure of an extraordinary Tide, the Water (tho' the Leakage may ſeem but ſmall at firſt) will then Augment it's Force, and undermining the Foundation of the Dam, will ſettle down from above, and tear away all before it.

And for the ſame Reaſon it is alſo abſolutely neceſſary, after the Foundation is ſecur'd, that the Body of the Dam be made and compoſed of ſuch Matter, as may be ſafely depended upon to be tight, and therefore by no means proper to have any Ships or Cheſts, or any ſort of Timber work whatſoever ſunk, or laid therein, to which the Earth, or Matter of which the Dam is compos'd, cannot bed cloſe, and muſt be a guide to Leakage: As for Inſtance, if but one ſingle Piece of Timber be laid or placed through a Dam, eſpecially near the Foundation, and where the Ground is bad, the Water will certainly penetrate on one ſide or other of ſuch Timber, and carrying always ſome Matter with it, will ſoon create a hollowneſs in the Dam, and cauſe the Earth to ſettle down from above, which upon the Preſſure of any high Tide muſt inevitably deſtroy the whole Work, and can never be truſted.

These Principles being laid down, I ſhall proceed to ſhow, that the Dam I intend to make for the effectual ſtopping up of the ſaid Breach, ſhall firſt be well ſecured, that there ſhall be no fear of any Leakage neither underneath at the

Foundation, nor on the Sides of the Breach or Creek; and Secondly, the Body of the Dam ſhall be entirely compos'd of good Earth, or Clayie ſort of Ground, from the very Foundation to the top thereof, without having any ſort of Timber Work, ſunk or laid therein, only I intend a Row of dovetail'd Piles, to be drove through the middle of the Dam, to ſecure the Foundation, and upon the Sides a ſtrong drift Work to be made, to be as a Buttreſs or Foot Wharf on each ſide to keep in the Earth, with which the Dam is to be filled, to prevent the Dam from ſpreading and ſettling out at Foot; and on the outſide of the ſaid Wharfs which are to be built only a little above low Water Mark, a ſtrong Wall, or Foot of Chalk, to be laid equal with the height thereof. The dam thus finiſhed without any ſort of Timber Work but what will remain conſtantly wet, will, with very little or no Repairs, ſtand faſt and endure for ever, and the Method which I deſign to proceed in, in the Performance, is as follows.

NEAR the Banks of the *Thames* on the Starboard or Eaſt-ſide, going into the Mouth of the Breach, right againſt the place where I deſign to make my Dam, I ſhall dig down a place in the firm Land, for the fixing of a Sluice near 40 Foot Broad, and for the Foundation to be palc'd at leaſt down to the depth of low Watermark, as before mention'd, to be made with a ſet of draw Doors, on purpoſe to ſhut down and draw up as ſhall be occaſion. And after the Sluice is thus compleated,

pleated, a Canal muſt be cut through from within the Dam that is to be made in the Breach, to the *Thames*, to let the Tides have their free Courſe through the ſaid Sluice, until ſuch time as the Foundation of the Dam is ſecur'd, and fixed quite a croſs the Breach, to about two or three Foot heighth above the Surface of low Water Mark, which I intend to do as follows.

FIRST, I deſign to drive down a Row of Piles as aforeſaid, Dovetail'd into the Sides of each other, as deep as they will go, about 6 or 8 Foot or more, according as the Ground proves, into the Foundation, quite acroſs the Creek where the Breach is to be ſtopp'd up, and extending, at leaſt 20 or 30 Foot into the Banks on each ſide, the whole way to ſecure the bad Ground, leaſt the Water ſhould any where penetrate and undermine the Foundation, by the want of which being ſecured in the Attempts hitherto made, the Water has ſtill bored under the Foundation, and has been the great Cauſe why the Work after being more than once ſtopp'd up at the low Water Mark, has broke down again, and the Breach been ſtill worn broader and deeper by it, and unleſs this great Evil of the bad Ground which is at the Foundation, be rightly provided againſt, it is too much to be fear'd that all Attempts whatſoever, will ſooner or later have the ſame unhappy event, and I am very Poſitive, that there is no other way in the World whereby it is poſſible to ſecure the ſaid bad Ground but by driving Dovetail'd Piles: And which tho' I have laid down this Method, every

Man is not capable to put the ſame in Practice, with that Truth and exactneſs required in the doing of it.

I deſign to begin firſt and drive the ſaid Piles in the firm Land or Banks, on each ſide of the Creek, and continue them on by a fair Line until they meet and ſhut up with the laſt Pile in the middle of the Breach or Creek, and as I go on with driving the ſaid Piles, and thereby ſtop the Courſe of the Stream, I deſign at the ſame time to advance and carry on the aforemention'd Foot-Wharfs, on each ſide at about 40 Foot diſtance, from the ſaid Line of Dovetail'd Piles: Which Foot-wharfs I intend to be made about 18 or 20 Feet Breadth, to be filled with Chalk, and Chalk Rubbiſh, and as they are carried on, a ſtrong Bed of Chalk is to be continued on the outſide alſo.

By Reaſon of a free Paſſage being made for the Tides, through the Sluice as aforeſaid, the Stream will not begin to run with any conſiderable Force in the Breach until the ſaid Row of dovetail'd Piles come near to be ſhut up in the middle, and then there will be occaſion to find means to ſecure and ſupport the Heads of the ſaid Piles, againſt the Weight of Water, which will (as the Tides ſet in and out) begin to be pent higher upon the Ebb, on the one ſide, and on the Flood on the other, and for which nevertheleſs, an opportunity muſt be taken to ſhut the ſaid Piles at the dead of the neap.

The time which I deſign to carry on the ſaid Works, will only be at the latter part of the

Ebb

Ebb, and the firſt part of the Flood, when the Tides being much below the Surface of the Land, and having Communication only with the Creek or Arms, cut and worn into the Land by the Breach, will have no great Power, till riſen to a greater height, and I ſhall leave the Heads of the Dovetail'd Piles not above a Foot or two above the ordinary Surface of low Water-mark, and thoſe belonging to the Foot-wharfs but very little higher, ſo that when the Tides come to riſe, and ſpread upon the low Land, and ſet either in or out of the Breach with any conſiderable Force, there will then be depth enough for the Water to run over the tops of the ſaid Piles, beſides, having a free Paſſage through the Sluice, until all the Piles are drove from ſide to ſide, and the Breach quite ſtop'd up at low Water.

THE ſaid dovetail'd Piles muſt be made about Seven Inches thick towards the Sides, and eight Inches towards the middle of the Dam, where the Water is deeper, and being jointed the whole way into the Sides of each other they will be like one ſolid Piece, or ſheet of Timber, driven at leaſt 6 or 8 Foot into the Ground, both quite athwart and into the Banks on the Sides of the Breach or Creek, and being made of Fir Timber, will ſwell and be tight, as I have experienc'd the Practice of in the *Czars* Country, where I have had from 20 to 26 Foot Preſſure of Water more upon one ſide of my Dam, than upon the other, and have been oblig'd ſometimes to fix my Works in Ground that has been very bad, and yet my Dams have not leaked nor been de-

ſtroy'd by the Floods, which in that Country are very Powerful upon the ſudden melting of the Snow in the Spring of the Year: The particular Engines, and Stages to be us'd, and the manner of driving the ſaid Piles regular and true, as alſo after what Manner to ſupport the Heads of them when they come near to be Shut up, I am ready further Verbally to explain, if required of me.

As the ſaid row of Piles are drove through the Dam, and the courſe of the Stream thereby ſtop'd at Low Water, the filling of the Foot Wharfs with Chalk as afore mention'd muſt be continued, and all the way between the ſaid Foot Wharfs, the Body of the Dam muſt be fill'd with the beſt ſort of Earth or Clayie Ground that is neareſt at hand. And to prevent and gradually take off the Force of the Tides ſetting in and out of the Breach after the Dam is once ſtop'd at Low Water, and carrying up to a greater height, then, every Tide the Doors of the Sluice muſt be conſtantly Shut down to Pen the Water wholly in, juſt when ebb'd off equal with the height the Dam is rais'd to in carying up of the Work, as alſo muſt be obſerv'd upon the Tide of Flood when the Water is riſen to the ſame Height without in the *Thames*, as it is penn'd up to, within in the Breach, the Doors of the Sluice muſt be immediately drawn up, that the Tide may equally Swell within as well as without the Breach, and thereby Eaſe the fall of Water in the Running of the Tides over the top of the Dam.

THE

THE Dam after once ſtop'd at Low Water may be conſiderably advanc'd every Tide when 'tis Weather for Men to Work, and will not require many Weeks to raiſe the ſame high enough to Shut the Tides wholly out of the Low Land, ſufficient Hands being employ'd for it.

BUT ſince it is certain that beſides the Injury to the Navigation of the River, the difficulty and Expence of making good the ſaid Breach in a Place that has ſo many Times given way, and is ſo much deſtroy'd, will be abundantly greater than if it had happen'd in any other part of the Banks of the *Thames*, ſo much the more care ought now to be taken that the ſame may never be in danger of breaking out again, any where in or near the preſent Breach, therefore it will be neceſſary to raiſe both the ſaid Dam and the Banks Adjacent, to be (after well ſettled) at leaſt a Foot or a Foot and a half higher than any other Place of the Levels, ſo that altho' the Tides ſhould happen by any Violence of Weather to riſe higher than was ever yet known, and quite overflow all the Banks of the *Thames*, it may never endanger doing the ſame any hurt; for in caſe of ſuch a Tide as is ſuppos'd, where the Water once takes power, the Violence of the Stream is always Strongeſt in the loweſt Place, and only where it firſt gets over, there it preſſes with ungovernable Power, deſtroying all before it; whereas at ſuch Places that are made higher, tho' alſo happening to be overflow'd, yet the Tides by firſt running over

the

the low Places the length of the whole Level, will have fill'd the Marſhes, and the Water becoming on a Level, can move with no Fall or Force of the Current, either upon the Flood or the Ebb, to break down or do any Damage to ſuch Places that are rais'd higher than the reſt of the Banks, provided there be no Leakage at the Foundation, to cauſe the ſame to ſettle down by any Force of the Tides.

THUS I have propos'd my Work firſt to be made effectually ſecure at the Foundation.

SECONDLY, To be made in that Order, and compoſed of ſuch Materials, that will not be ſubject to Rott and Decay.

THIRDLY, That altho' the Floods and Storms ſhould happen to be greater than was ever yet known, the ſame to be ſo finiſh'd as not to be endanger'd thereby.

LASTLY, When both the ſaid Dam is compleated and the adjoyning Banks raiſed to the height that is requir'd, then the aforementioned Canal made for the diſcharge of the back Water muſt be alſo effectually ſtopp'd up, and the Sluices broke down and taken away; for otherwiſe the Sluice when once decay'd, would give way and endanger the making of a new Breach.

THUS

THUS I have fully laid down my intended Method, as to all the Main and moſt Material Points for the Performance of the ſaid VVork, with my Reaſons about the ſame. And any thing elſe which may not be rightly underſtood, I am ready further Verbally to explain (if Commanded,) on Condition that no other Perſon ſhall afterwards be employ'd upon the ſame without my Conſent, according to my ſeveral Propoſals delivered to the Right Honourable the Truſtees on the Dates aboveſaid.

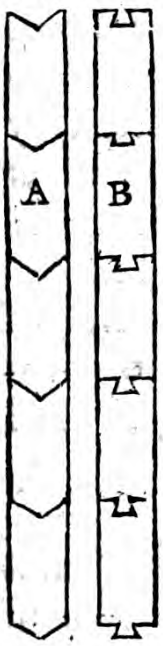
London Dec. 12. 1715.

THIS Deſcription, together with the Draught, or Plan, of the Foundation of the VVork as I propos'd the ſame to be carried on, particularly with Relation to the Foot-wharfs and Dovetail'd Piles to be drove for ſhutting the ſame to the Low VVater Mark, I laid before the Gentlemen conven'd as aforeſaid, who upon Examination thereof, agreed in their Opinion, that the driving of Dovetail'd Piles in the Manner deſcrib'd, muſt certainly be the moſt ſecure Method for preventing of Leakage, and ſtopping the Breach, provided the ſame could be reduc'd to Practice, but no Inſtance being known in *England* of ſuch Method experimented in the like Caſe, of making of Dams, tho' ſome Gentlemen very readily approv'd it, yet there were others who doubted, whether

whether in the Violence of the Stream which ſet in and out of the Breach, ſuch Piles beginning at each End of the Dam(as laid down in my Deſcripition) could be brought by a ſtraight Line in the depth of 20 Foot of VVater taking the Time of Low VVater for it, to meet in the middle of the Breach, and be out of winding,(*viz.* the Heads and the Points to be Parallell to each other) in the ſame continued Line as firſt drove down, ſo as by one ſingle Pile at the laſt, to be enter'd at the Heads of thoſe on each ſide, to joint cloſe into the Grooves made for it in the driving down, and make an effectual Shut like one entire Sheet of Timber. But upon my Reaſons and Verbal explanations of the Methods I intended to uſe for the facilitating this Difficulty, and for Securing the ſaid Piles by the help of the Foot-wharfs, from their being born down by the Tide. Likewiſe upon the Affidavits I produced, of my having Practis'd the ſame Method in the Performance of conſiderable VVorks in *Ruſſia*, it was Unanimouſly agreed that what I propos'd was the only probable way to Succeed and Effect the VVork, and declar'd it their Opinion, that if it could not be done by Dove-tail'd Piles, it was impoſſible ever to be done by any of the Schemes which came before them, or other Method whatſoever:

As I ought to be very Cautious not to mention the leaſt Syllable but what was agreed and declar'd

declar'd to be the Opinion of thoſe Gentlemen of Judgment and Honour who were then preſent; ſo I do not remember there was any other Debate concerning the Method laid down, excepting with Relation to the Practice of placing down a Sluice in bad Ground, which I gave them Satisfaction in; and whether driving Angular indented Piles as the Heads are deſcrib'd at



Letter A, uſed by the *French* at *Dunkirk*, and in the ſecuring of their late Works at *Mardyke*, might not be preferable, which was objected by ſome of the Gentlemen who were preſent. But upon my explaining to them, that I did not apprehend any Method whereby it was poſſible to guide ſuch indented Piles down by the Sides of each other, and to keep them cloſe join'd at the Foot in a continued Line in the Depth of Water, and force of the Current which was at the Breach, that I could not therefore conceive, how the ſame could in any Degree be depended upon, comparable to Dovetail'd Piles deſcrib'd at Letter B, as above, which being enter'd at the Head, would keep cloſe join'd to each other all the way down in the Water, and afterwards upon the Entrance into the Ground, by the needful Care taken to cut them with a Proper Snape for it, as in the Practice found requiſite; it was upon Conſideration hereof entirely agreed, That what

I propos'd, was preferable to the Method us'd by the *French*.

A Gentleman who had made his Propoſals to the Truſtees at one of their Meetings before, and attended that Day, deſir'd a further time to bring his Scheme and Model before them, and a further time was appointed, and Brigadier *Richards* with the other two Gentlemen aforenam'd (to whoſe Judgment, great Regard was obſerv'd,) were again deſir'd to meet for the Examination of what might be further offer'd by the ſaid Propoſer, or any other Perſon, and at their ſecond Meeting, having wholly rejected what came before them as Deficient and Impracticable: They were again pleas'd (upwards of Thirty of the Truſtees being preſent) to Confirm their Opinion of the Scheme which I had laid before them, without one Hand held up againſt me, as I have been inform'd.

WHEREUPON after the Truſtees had thanked the Gentleman who did them the Favour of their Aſſiſtance, and they had taken their Leaves, the Court came to the Reſolution to Contract with me.

IT being laid down in one of my Propoſitions (which were then before them) that I was willing to undertake the Work for the Sum of Twenty ſeven Thouſand Pounds at my own Riſque, and to give Security for the Return of all ſuch Sums which I ſhould receive in Caſe of my Failure in the Succeſs: Or otherwiſe,

if

if the Truſtees ſhould pleaſe to agree with me, I was willing to procure five Thouſand Pounds to be advanc'd by my Friends at their Hazard in caſe of my Work not proving Effectual, with which Money I propos'd to begin and carry on the ſame, until the ſaid Sum ſhould be expended thereon; And that the Truſtees without Security, ſhould then ſupply me out of the Publick Fund with what further Money ſhould be neceſſary for the Performance. Upon which Terms I was ready to undertake the Work for the Sum of Twenty one Thouſand Pounds, provided, that if any Unforſeen Accident ſhould Occaſion the Expence of a much greater Sum, and the Work ſhould at laſt be Effected, the Truſtees, ſhould then Recommend me to the Conſideration of Parliament for a Reward.

A Debate hereupon aroſe, that ſince the Method which I had laid down and demonſtrated to them, carried with it ſo great a Probability of Succeſs, and that ſince the afore-mentioned three Gentlemen had fully declar'd their good Opinion, not only of my Scheme, but my Ability to put the ſame in Execution, whether it was not therefore adviſeable to contract with me for the leſſer Sum which I propos'd, whereby in Caſe of my accompliſhing the Work without any Misfortune, a conſiderable Sum of Money would be ſaved to the Publick, or whether they ſhou'd agree with me for the larger Sum

Sum which I propos'd, whereby in caſe of my Failure in the Succeſs, the Publick Fund would ſtill be preſerv'd; upon which Debates, the Truſtees inclin'd to the latter, and it was at length determin'd, that a Propoſition ſhou'd be made to me to recede from the Sum of twenty ſeven thouſand Pounds, which I had demanded, and to contract with them for the Performance of the VVork for 25000 Pounds with ſecurity to be given them as above, and that upon my Conſenting thereto, the Truſtees ſhould make me their Promiſe, that in caſe that I did effect the VVork, and it ſhould afterwards appear, that by any unhappy Accident or Misfortune in carrying it on, the Sum which I contracted for ſhould fall ſhort, that then the Truſtees ſhould recommend me to Parliament, not only to enable me to diſcharge the neceſſary Engagements which I ſhould enter into for the Performance of the VVork, but alſo for ſuch Reward as the Houſe ſhould think fit.

AFTER the Truſtees had determined in this Manner, I was call'd in and acquainted with this Propoſition to me, which I readily ſubmitted and agreed to: Whereupon the Articles of my Contract were accordingly ordered to be Drawn, an Abſtract whereof is at the Latter end of this Treatiſe tranſcrib'd. I was inform'd by the Truſtees at the ſame Time, that the Minutes of my Agreement being enter'd into their Books, the ſame was as binding on their Parts, as if ſealed and

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executed, and whilſt my Contract was ſettling, I might go on and looſe no time in Expediting my Work, I thereupon began to buy the neceſſary Timber, and Materials, and ſet a Conſiderable Number of Artificers to Work in a Yard which I had hir'd at *Rotherhith*, for the framing of a Sluice, getting ready my Dovetail Piles &c. and other Hands I got together without delay and ſet to Work at the Breach, to put forward and ſecure the ſame from growing any worſe. A Slip having happened in the Walls of the Levels about that Time, which gave a Rumour in the Country of a New Breach.

But whilſt I was thus proceeding, and my Contract was drawing and ſettling by Council, a Petition from Mr. *Boſwell*, and ſeveral others, was preſented to the Honourable Houſe of Commons, Complaining of the Proceedings of the Truſtees, charging them with giving an undue Preference to my Propoſals, and alledging, that ſeveral able Mathematicians, who had conſider'd my Scheme, had declar'd it to be altogether Impracticable, *&c.*

Hereupon I was oblig'd, in a great Meaſure, to neglect that due Application which was neceſſary, for the putting forward my Work at the Breach, and to give my Attendance at the Houſe, whither I was ſummon'd to attend a Committee which was appointed to Examine into the Matters charg'd in the ſaid Petitions.

TOUCHING which, I ſhall chiefly here take notice of what was Inſinuated or Charg'd againſt me, with relation to my Ability, in the Method I intended for the Performance of the Work. And for what was reflected on the Truſtees, I ſhall paſs by, as having been ſufficiently Anſwer'd by themſelves.

ONE of the Mathematicians mention'd in a Petition lodg'd againſt me, who attended at the Honourable Committee of the Houſe, to bring his Objections againſt my Scheme, alledg'd, that it was impoſſible, in his Opinion, to drive down a Row of Dovetail Piles in one continu'd Line, in that depth of Water athwart the Breach, as was by me Projected, without their being born down and torn away, by the Strength of the Current ſetting in and out of the Breach.

UPON which he was ask'd by a Member of the Committee who was a Truſtee, if he had diſcours'd with Captain *Perry*, or knew what Engines or Methods he intended to make uſe of, for Removing his Objection; he reply'd, that he had never ſeen or ſpoke with me, and being ask'd, if he had ever ſeen my Scheme, he again reply'd in the Negative, whereupon he was then further ask'd if he had ſeen the Breach, and he declar'd he had never been there. By this Gentleman's Replies, I obſerv'd, that his Objections made no Impreſſion upon the Committee, nor needed any Anſwer from me; and indeed upon all the Scruples and Suggeſtions which were brought

brought againſt my Works, and upon the Examinations of the ſeveral Schemes and Propoſitions made by others, I did not find that the Objections which were raiſed had ſo much Force as to move the Committee once to enquire of me any Reaſons in anſwer to them.

Particularly, I was order'd to be preſent when the Draught or Plan of my Scheme was laid before the Committee, and Deſcription thereof was read, when alſo ſuch Perſons who had propos'd to make good their Charge againſt my Scheme, were ſummon'd to be preſent, and did attend, (at leaſt ſome of them) but I do not remember that any of thoſe Gentlemen objected to any part of what they heard read, or to the Plan which was laid upon the Table; only a Gentleman (who was a Member of the Committee) ask'd for a Model of my Scheme, which all the other Propoſers had produced; upon which another Member of the Committee (who was one of the Truſtees) anſwer'd, that I had no Model, and that I had never preſented to them any thing at *Guild-hall*, but the Deſcription and Plan which was then upon the Table.

Thus no Perſon could, or at leaſt did maintain any rational Argument or Objection againſt the Method which I produced; on the other hand, the three before-mention'd Gentlemen, who had been deſired to meet the Truſtees for their Opinion, upon the Examination of Mat-

ters at *Guild-hall*, were twice order'd to attend in Parliament on the Subject of the Petitions which were lodg'd, particularly on the Day when my Scheme was appointed to be examin'd, and there again repeated their Opinion to the Committee, that there was no probability of the Breach being ever ſtopped, but by the Method of Dovetail Piles; and that if it was not found practicable to be done by ſuch Method, it was impoſſible to be done by any other.

One of the ſaid Gentlemen more particularly expreſs'd, That he had ſeen and examin'd all the Schemes which had been offer'd, and did me the honour to ſay, That he ſaw no Scheme equal to mine, nor any other Perſon equal to his own Scheme; for that they had propoſed doing of many things, which upon their being examin'd, they were not found capable to put in practice: but in all the Queſtions they had ask'd me, I had anſwer'd them like an Artiſt, and like a Workman, and that therefore it was not only the Scheme, but the Man, which they recommended. Another of the ſame Gentlemen not only declar'd his Opinion with reſpect to what I had laid down, being the only probable Method of performing the Work, but went further, and ſaid, That he verily believed I would do it.

However, the inſerting this may ſeem to offend againſt the ſtrict Rules of Modeſty; yet it having carry'd weight with the Committee, and there

there being a Proſpect of ſome other Things, in which I may be found capable of ſerving my Country, I thought I could not in Juſtice to myſelf, omit the Character thoſe Honourable Gentlemen were pleas'd to give me.

THERE were alſo other Matters examin'd in the Committee relating to the regularity of the Proceedings of the Truſtees, and ſome Debates likewiſe aroſe, whether the ſtopping of the Breach was at all neceſſary for the preſerving the Navigation of the River. But the Honourable Members of the Houſe who belong'd to the Royal Navy, declaring Their own Knowledge of the Miſchief to the River that accru'd by the Breach, and Opinion of the Neceſſity of having the ſame ſtopp'd.

AFTER upwards of Ten Weeks was elaps'd and no one Point of Fact alledg'd, made to appear, the Committee was diſmis'd, and the Houſe declar'd, by their Vote, that the Truſtees had done their Duty.

THESE Delays and Obſtructions prov'd unfortunate to me; not only becauſe a conſiderable part of my own Time was expended in my Attendance on the Committee, which at my firſt ſetting out was more eſpecially neceſſary to have been employ'd at the Breach, by Reaſon my Work was in a Method entirely new, and unexperienc'd by thoſe Perſons appointed to carry on the ſame in my Abſence. But in the Inte-

rim of the Determination of Parliament, it happened that the Price of Timber and Iron Work advanc'd upwards of 20 *per Cent.* which prov'd ſome Diſadvantage to me. Farther, all the while that Matters were depending in the Houſe, the Truſtees refus'd to Act, and it was not until the Eighth Day of *June* the ſame Year, that they ſign'd the Contract made with me, or order'd any Money to be advanc'd to me: So that on this Account my going on with my Work, which I however in ſome Meaſure ventur'd to do, that I might be in what forwardneſs I could, was deem'd by my Friends to be not without hazard of the Money which I expended thereon.

ON the whole, thro' theſe Hindrances, the Spring and the beginning of the Summer was in ſome Meaſure loſt to me, and notwithſtanding, that as ſoon as the Houſe had confirm'd the Proceedings of the Truſtees, I us'd my utmoſt Application to put forward the Work to recover the loſt time, yet I found my ſelf ſo ſtreightned the enſuing Summer, that the Sun came to the *Equinox*, and the Days grew ſhort, and the Weather precarious, before I could turn the Tides out of the Levels, which tho' I then ſucceeded to do, a very evil Accident accompany'd me therein; for before the Work was finiſh'd to its due heighth, upon an extraordinary Tide which happened on the 10th Day of *September*, 1717

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the Water flow'd above what my Works were then rais'd to, and tore down the ſame to the Foundation, after the Tides had been only five Days turn'd out of the Levels, which coſt a very great Expence and Labour again to recover.

THE manner of my Proceedings in carrying on of my Work, and the Occaſion of the particular Misfortunes which I have met with, I will go on to give a more diſtinct Account of; which I am the more willing to do, to clear it from the wrong Imputations, and various miſguided Notions which have been conceived of it; and, that other Perſons may, by a true Light, be able to avoid the Miſchief of any like Accident.

AS ſoon as the Houſe had confirm'd the Truſtees in having done their Duty, I waited not for the Execution of my Contract, but directly entertain'd all the Hands I could get, and ſet them to work with the beſt Expedition I could, in the digging of a Canal, (for the Sluice mentioned in my Scheme,) and in the carrying on the Works for my Dam in the Breach, with Thoughts to have attempted the ſhutting in, and ſquaring the firſt heigth to low Water Mark the ſame Year, but when I came to dig down the Place for my Sluice, notwithſtanding that I had (when I came within about 6 Foot of low Water mark) driven down large Dovetail Piles, on

each ſide, and athwart the Place which I dug down for the moſt part upwards of 20 Foot into the Ground by extraordinary Engines for it, whereby to ſtop the Courſe of the Springs, which was done with large Beams of Timber fix'd a croſs from ſide to ſide, to prevent the ſliding in of the Banks, yet I found the Penetration of the Water to have that Force underneath the Dovetail Piles, thro' the Sand and bad Ground below the Moorlogg, * that the Preſſure of the Water at the Depth

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* Moorlogg, is a vein of divers ſorts of rotten Wood (Yew Timber only, which is found amongſt it being not decay'd) which lyes about 3 Foot and a half, or 4 Foot underneath the Surface of the Marſh Ground belonging to the Levels, about 10 Foot in depth, and with very little mixture of Earth that can be diſcern'd amongſt it; underneath it there is about 12 or 15 Inches depth of blew Clay, then Gravel and Sand. A great Part of this Moorlogg ſeems to be compos'd of ſmall bruſh Wood, and many hazel Nuts have been taken up in digging, which I have had in my Hand and look'd to be firm, but upon a very little preſſure they break to Duſt.

Some of the *Yew* Trees are found 14 or 16 Inches Diamiter and are perfectly ſound, excepting the Sap; the *Willow* or *Sallow* Trees, are many of them found ſome of two Foot and upwards Diamiter, and retain a whitiſh Colour like Touch-Wood, and ſo decay'd (where they lye) that Men cut into it with their Tools, with more eaſe than they do the Earth or adjoyning Moorlogg. But I have never ſeen any of that ſort of Wood which others have deſcrib'd, to be taken up Sound, and to moulder away upon its coming into the Air.

There have been found a little above the vein of this Moorlogg, *Staggs-horns*, particularly, my Men lately Loading of Earth into a Barge at Letter I, in the *Plan* of the

Depth which the Ground was dug down, being near Twenty-Two Foot Difference of Level upon the Spring-Tides; ſo ſwelled and lifted the Moorlogg in the Place for the Sluice, that it rounded up in the middle ſeveral Inches above the Level to which it was dug, and the Leakage began to take ſuch power, that I thought it not ſafe to open the Ground any lower,

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the Level prefixed, found a *Stag's-horn* of a middle Size, the largeſt Part of it quite rotten, and mouldered to Duſt in taking up, and other Parts honey-combed and rotten; and the ſmall Branches near the Tip (of which I have two by me) one of ten Inches, the other of ſeven Inches and a half length, are heavy, and the moſt part ſound. There likewiſe was another *Stag's-horn* found ſome Years before my Undertaking, about half way between the aforementioned Place, and the Mouth of the Breach.

From what Cauſe, or by what Means, this Thickneſs of Moorlogg, which is found underneath the Surface of the Marſh-Ground (as deſcribed) has been produced, and generally lies in even and regular manner, being nigh ſix foot thick above in the *Thames*, at *Deptford*; where Capt. *Bronſdon* lately repaired his Docks in *Woolwich-Reach*, over againſt the *Ballaſt-Wharf*, between ſeven and eight foot; in *Plumſted-Levels*, againſt *Barkin-Creek*, nine foot; and gradually of a greater Thickneſs as well as Breadth, going down on both ſides of the *Thames* below the Breach, as the Marſhes extend; the Thickneſs of the Marſh-Ground, which lies upon it, being near alike, and none of it to be ſeen at any Place where the Courſe of the River cuts into the Highland (as at *Woolwich*, *Erith*, *Purfleet*, *&c.*) I ſay from what Cauſe this has been, I will leave to Gentlemen who may employ a Thought this way, and will omit my own Opinion in this Place, with what other Obſervations of the like kind I have made in Foreign Parts.

lower, and ſubmitted to fix the Foundation (or Apron) of the ſaid Sluice, to a leſs Depth than I would willingly have fixed the ſame to; and conſequently as I could not place the Sluice to a greater Depth, there could not, in the Courſe of carrying up my Works in the Breach, be given ſo great an Eaſe and Vent to the Water, by way of that Canal, as was neceſſary; the Top of the Apron being fixed only to within a Foot of the Depth of the ordinary Low-water Mark in the *Thames*, which would have been of much more Service and Satisfaction to me, could the ſame have been carried lower.

This Reaſon, together with the Obſervations which I made upon the Advance of my Dam in the Breach, that the Force of the Stream in the Breach, as the Works were carried on, and the Paſſage became contracted, began to operate with great Violence, led me, for a greater Security of my Work being effected, to alter my firſt Intentions of making but one Canal, and thereupon reſolved to dig another, and to fix down a ſecond Sluice to what Depth I could obtain. And that until I could have the Advantage of both Canals, for the greater Eaſe of the Water running in and out of the Breach, not to attempt the cloſe of my Dam, leſt I ſhould be under any Difficulty therein, particularly doubting whether I ſhould be able to draw off the Water low enough by the

the Sluice, which I had plac'd to lay the Surface of my Works dry after I had cloſed my Dam.

And it being the ſpring of the Year 1717. before I could finiſh the Second Sluice, and compleat the opening of that Canal, which I found equally difficult in the fixing down that Sluice as the firſt, ſo that tho' I carried the Foundation to a conſiderable depth beyond what was poſſible to have been done without the ſaid Drift of dove-tail'd Piles, yet found I durſt not venture the fixing of the Apron of either of them below, or fully to the depth of low Water-mark, leaſt I ſhould have been over Power'd by Springs and Leakage.

By theſe Obſtructions, and alſo by a conſiderable Froſt and drift of Ice, which happen'd that Winter, I became backward in my Work, and could not make the Cloſe of my Dam to low Water in the Breach, until the beginning of *June*, 1717. and then the Time near approaching, according to the Letter of my Contract, for turning of the Tides out of the Levels.

Some of my Securities became uneaſy on this occaſion, particularly a near Relation of mine, apprehending that I ſhould be driven upon the Winter Seaſon, before the Tides could be turn'd

turn'd out of the Levels, which was look'd upon muſt be attended with evil Conſequences, ſo that I was by Importunities and Diſorders ariſing, preſs'd forward, to neglect thoſe principal Rules, which I had laid down in my Scheme (as abſolutely neceſſary for doing the Work,) namely, the Compoſing the Body of my Dam, with ſuch good Earth or Clayie ſort of Ground, as was near at Hand, with alſo the neglect of ſome other Points, which I ſhall mention, and blame my own Conduct in ſubmitting to.

FIRST, As to my departing from my Judgment, laid down in the 5th and 12th Paragraphs, of the Deſcription of my Scheme, and ſuffering the Dam to be at all Rais'd with worſe Earth than I had determined: There is every where upwards of 3 Foot deep from the Surface of the marſh Ground, in the Levels belonging to the Breach, very good Earth or Clayie ſort of Ground for the purpoſe of making of a Dam, but then there is near a Foot deep of bad Earth, underneath that which is good next to the Surface of the Moorlogg, and in other Places a good deal of ſoft Earth or Mud, which ſince the Breach where the Current has not been ſtrong, has ſettled and lodg'd upon the Surface of the Marſh Ground, by the Circulation of the Waters, in and out of the Levels, and altho' I gave ſtrict Dire-

Directions from Time to Time, not to ſuffer any bad Earth to be brought into the Dam; yet being obliged to work, in carrying up of the Dam by Night, as well as by Day (as the time of Tides happened) and having, for the ſake of Expedition, agreed with the Men, to dig and carry the Earth by the Tun (it being obſervable that they worked two or three times as much by Task-work, as by the Day, or by the Tide) for the eaſe of their Labour; they wilfully brought ſoft and bad Earth to the Works, eſpecially in the Night, mixed more or leſs with that which was good, as they found they could impoſe it; and the Practice of this ſtill grew worſe and worſe, as they found me neceſſitated to put forward my Works, notwithſtanding the preſſing Orders I repeated to my Aſſiſtants (who were five in Number) that they ſhould not ſuffer any bad Earth to come into the Dam. And finding my Directions, in this Particular, not comply'd with, and that generally the Earth was ſo ſoft, that a Man, ſtepping upon it, would ſink over his Shoes (as many of my Friends do remember) I then, upon my own more ſtrict Inſpection into it, ordered all ſuch Barges, wherein there was a mixture of any ſuch bad Stuff found, to be turned away from the Works, to throw it into the Water, and to abate the Men of their Wages who brought it: upon which, Diſputes and Mutinies frequently aroſe, the Men vouching he Stuff which they brought to be good;

good; and when I order'd it to be turn'd away, and thrown into the Water, would put on their Clothes, and leave off Work for ſeveral Days together. Whereupon, my Aſſiſtants (particularly a Perſon, who I had more than ordinary Reaſon to depend on) being influenced by miſguided Notions, that the bad Earth I objected againſt was not ſo neceſſary to be regarded as putting forward the Work, join'd in endeavouring to perſuade me to a Compliance with my Men.

I found all my Aſſiduity and Care not to have ſufficient Effect, and the Evil encreaſed upon me, when the Men came to work again; which obliged me to make ſtill ſtricter Orders, not to pay them any thing for ſuch Freights with bad Stuff, which they brought on the one hand, and raiſing their Wages, for bringing to the Dam, what ſhould be good on the other; whereby they could ſome of them earn, and were paid, as appears by my Books, from Thirty to Thirty-ſix Shillings *per* Man *per* Week: ſtill this did not divert them from impoſing upon me, but they grew more idle and diſorderly, as they had more Money to ſpend, and frequently would, One and All, (as they called it) leave off Work, inſiſting on more Wages, at the time when they ſaw my Neceſſity to be the greateſt, which was at the time when the Dam was raiſed more than half

Tide,

Tide up, and the Water upon its Flux and Reflux, ſet over the Works with the greateſt violence.

INSTEAD of my ſuppreſſing them, by not giving way to them, which I was of Opinion to have done, by letting the Work ſtand for a while, I found my ſelf the more ſtrongly Preſs'd to ſubmit to the Practices of my Men, the Opinion of my Aſſiſtants being urg'd, and the general vogue of Men that my Work was carried on in a ſufficient Manner, and only wanted to be Expedited before the Winter came on, and all that I could ſay of my being apprehenſive of the ſoft Earth ſpreading, as the weight of the Dam encreaſed upon it, and that I believ'd it better to be backwards a few Weeks in reſpect to Time, than to comply with any Evil in the carrying it on, this was imagin'd to be only a Humour in me, to find fault without occaſion (as 'twas Term'd) and I found my Aſſiſtants, ſo wrought upon by the Influence of my aforemention'd Relation, who had a Son in the Houſe with me, that upon my inſiſting on a ſtrict Obſervance to my Orders, (tho' they ſeem'd to give Ear to me) they determin'd amongſt themſelves, not to mind my blaming their neglect, but to let the Work go forward.

AND

And it being a prevailing Opinion drawn from the Practice of all the Undertakers, who had gone before me, that nothing but a great Number of Hands would be wanting to make a Puſh as it was call'd, to turn the Tides out of the Levels.

I found my ſelf from theſe Notions preſs'd on all Sides to get a greater Number of Men together, and in Conformance to the general Deſire of my Friends in this Point, I made Application to the Right Honourable the Lords of the Admiralty, and had the Favour of Men order'd from his Majeſties Yards of *Deptford* and *Woolwich*, I alſo rais'd all the Men round the Country that I could gather together, for turning the Tides out of the Levels, which was done at the time of the Neap.

Whilst I was thus proceeding, I remember a Gentleman in an Eminent Station in his Majeſty's Naval Affairs, who did me the Favour more than once of coming to ſee my Works, adviſ'd me not to go on in ſuch Haſte, but to give the Earth in my Dam due time to ſettle before I attempted to turn the Tides out of the Levels, whoſe Opinion it had been been happy to have follow'd.

My

My Dam had hitherto from the Foundation been carry'd up by Set-offs on each Side, of about ſeven foot in breadth, made by a drift of ſmall Piles, at the height of every three foot, or ſomething better, with Boards or Planks nail'd on the Sides of the Piles, as the Works were rais'd, and ſo much Earth as was fill'd, or laid on the Dam, every Tide, was conſtantly cover'd over at the top with Reeds and Hurdles, to prevent the ſame from being gull'd, or waſh'd away, by the Water ſetting in and out of the Breach. But upon the turning of the Tides out of the Levels, at the time of the Neap, a naked Wall of Earth, without any Piles driven, Boards on the Sides, or covering on the top, was propos'd by one of my Aſſiſtants to be carry'd up, by the great number of Hands there was for it, faſter than the Spring could be apprehended to riſe upon us; and, in conformance to the Expedition ſo much preſs'd to me, I agreed to this Method, in the hopes of Succeſs.

But when this Bank, or Wall of Earth, of a narrow breadth, came to be carry'd on in the middle of the Works, to about four foot height, and a Space, according to the main breadth of the Dam, left on each Side, about twelve foot, the Weight of this Wall, as it was laid upon the Dam, continued ſettling directly down into the

ſoft Earth, in ſuch manner, that before the ſame could be advanc'd to a ſufficient height, I was ſurpriz'd with an extraordinary Tide, occaſion'd by a Storm at N. W. the Sun being in the Equinox, and the Moon a Day after the Full; which Tide flowing above half a foot higher than the top of the ſaid Bank of Earth was rais'd, the Water ſoon waſh'd down the ſame, and, as it gain'd room, ſo encreas'd its Weight and Power, that, in leſs than two Hours time, where it firſt went over, it tore down the Body of the Dam, until ſtopp'd by the heads of the dovetail Piles, which were driven into the Foundation: whereas, had the Earth happily been *laid* on by Set-offs in height proportionable to the other Parts, defended with Piles and Boards, and cover'd over at the top, in manner as the other Parts of the Works were carry'd up, which prov'd ſufficient, when the Water paſs'd and repaſs'd every Tide, with much greater force and fall; in all appearance the Work would have ſuſtain'd no Damage from ſo thin a Body going over at the height it was then rais'd to, and there had been opportunity, with the number of Men, which I had at that time, (being upwards of three hundred) to have added new Matter and have rais'd and brought the Work into ſufficient Security, before another Spring came on; eſpecially

eſpecially had the Earth been good which was put into the Dam, (as laid down in my Scheme) the Miſchief had more eaſily been prevented, and the Work, at my firſt Endeavour, been happily compleated.

THE Difficulties and Accidents which I have met with, having occaſion'd various Opinions and Reports, that my Works have been blown up, through not being ſecur'd at the Foundation, or born or broke down by the Force of the Tides for want of due Strength; I therefore think it proper here to take notice, *Firſt*, that my Work has always been effectually ſecur'd from blowing up, or any Penetration of Water paſſing underneath the Foundation or Bottom of my Dam, by the Drift of dovetail Piles, *&c.* (as laid down in the Deſcription of my Method, which was examin'd by the Truſtees) and as has been evident to every Perſon's Obſervation, who has ſeen the Work.

AND touching the other Suggeſtion alledged, I muſt deſire the Favour of the Reader to look back to the Deſcription of the Nature and Preſſure of Water, which is before laid down.

I HAVE ſhewn in treating of Mr. *Boſwell*'s Sluices, that the Weight of Water lying againſt any Thing, is always to be computed from the height, which the ſame riſes or is penn'd up to. We ſee by the

Practice of Boys and common Paviours in the Streets, that a very little Matter, (though laid upon Stones, which are a guide to Leakage) will make a Dam with Dirt, that will pen up a Foot of Water. And again, for the making of Gentlemens Ponds, or to pen the Water out of Meadows, where the Riſe of any Flood is not known to be great, a very ſmall Bank in breadth is ſufficient for the height of three or four foot; and if the height be five or ſix foot, then the magnitude of the Dam muſt be in proportion encreas'd, with the beſt of Earth to be ſought for it. And it is certain, that no Weight inferior, where the Motion is gradual, or without Velocity, (as is the Riſe of Water by the Flux of the Tide) can force or bear down a Body ſuperior. And to clear up the aforeſaid Aſperſion of my Works being broke down by the Tide, for want of due Strength, I will here compute the Weight of Earth, which my Dam was compos'd of, and the Weight of Water which lay againſt it.

THE height which my Dam was raiſed to, at the time of turning the Tides out of the Levels, (as before related) reckon'd from the bottom of the Breach, in the deepeſt Place, to the top of the Works at the ſaid time, was 35 foot, and the breadth at the bottom of the Breach was

150 foot; and at the height the Foundation was made to above the Low-Water Mark 104 foot, and at the height to which the Work was carry'd, to the turning of the Neap Tide out of the Levels, 36 foot: upon which breadth the narrow Wall before mentioned was attempted to be raiſed, for compleating the Work to its full height of 42 foot deſign'd. Now without computing any thing for the aforeſaid Wall, which was irregularly made, let the 36 foot breadth at the top, and the breadth of 150 foot at the bottom of the Breach, in the deepeſt Place, be added together, and take the half thereof 93, the mean breadth one with the other, and multiply it by 35 the Depth, and the Sum will be 3255, which is the Quantity of cubical Feet of Earth and Chalk together, contained in one foot length of the Dam made a-croſs the Breach; and every foot of Earth being ſuppoſed to weigh about 96 Pounds, (or one Third more than what Water weighs) the whole weight of Earth, for one foot length of the Dam at the deepeſt Place, (as before mentioned) will be 312480 Pounds; or, divided by 112, makes 139 *Tuns*, 10 *Ct.* and proportionable for the reſt of the length of the Dam. Again, let the weight of Water be computed at 4 foot greater height than is done for the Dam, or 39

foot in Depth anſwering to the full Height that the Tide roſe, which went over the foreſaid ſmall Dam or Wall which was rais'd upon my Works; and according to the Principles of computing the Weight of Water laid down in the former part of this Treatiſe by the Triangle *A*, let the ſaid Depth of 39 foot at the deepeſt part of the Breach be multiply'd by 19 and ½, which is the half Depth of the ſame, and the whole Quantity of Cubical Feet of Water preſſing againſt the Dam for one Foot in Length croſs the Breach, will be 760½; and multiplying the ſame by 64, the Weight of one Cubical Foot of brackiſh Water gives 48672 Pounds, and divided by 112 makes 21 *Tuns*. 14 *Ct*. 2 *qr*. 8 *l*. which proves, that the Weight of Earth of which the Dam was compos'd was more than 6 times ſuperior to the Weight of Water preſſing on the Outſide of the Breach on the Day when the Accident happen'd, without taking notice of the Wall of Earth rais'd upon the Dam, or the Counterpreſſure of about 26 foot depth of Water, which was on the Inſide.

HAVING thus ſhown how much ſuperior the Earth in my Dam was to the Weight of Water, as well as anſwered the other Objection before ſuggeſted; I will now go on to relate my Proceedings in Repairing the Damage ſuſtain'd.

It happen'd to be in the Day-time, and my Men in full Work, when the Tide before mention'd was obſerv'd to riſe much faſter than it had been known, in all the time of my Undertaking before; and being very apprehenſive of the Miſchief that muſt enſue if the Tide went over ſuch a green Bank or Wall of Earth, I got ſmall Piles drove, and Boards ſet on edge from end to end, to be a Fence to the Tide above the Height to which the Wall was rais'd. But unhappily this met with no Succeſs: the Water, when the Tide came to riſe, penetrated underneath the Boards, which were in ſome places ramm'd with Clay, and in other places defended with Sails, to prevent it; and finding immediately that the Water took ſuch force, that it was paſt remedy to prevent its being tore down as low as the Works were firſt made above the Low-Water Mark, therefore I order'd the ſaid Boards inſtantly to be cut down in two other places, whereby to give the greater Eaſe to the Fall of the Water: for otherwiſe, only operating in one place, where it firſt got power, the Miſchief muſt have followed, either that the Water would have worn ſo much towards one end of the Dam, as to have got behind or beyond the Row of Dove-tail'd Piles driven in the Fonndation, and have made ſuch exceſſive Depth there, that could not have been recover'd without the Augmen-

tation of a very great Expence; or at leaſt had it not gone beyond them, the continued Violence of the Current ſetting in and out of the Breach (when confin'd to a narrow Paſſage) muſt have broke down the Dove-tail Piles, and tore away the Foot-Wharfs and Foundation of the Works to ſuch a Depth, that it would have been very difficult to have found hold in the ground to drive new Piles for making good the Damage ſuſtain'd: It being always true, that where any River or conſiderable Body of Water ſets in or out of any Place that's ſtreightned or pent up, what it wants in the Breadth, it labours with the greater force to make its own way in the Depth; and where the Ground is bad, as in the place of my Works, the Miſchief muſt have prov'd much greater than it did, had it not been prevented by the immediate Application before ſet forth, and continu'd on for ſeveral Days after, by keeping as many Men as could be employ'd every Tide as the Water ebb'd off, conſtantly in cutting away the Timber-Work, and digging down ſuch parts of the Earth in the Dam from end to end, which did not ſuffer by the Accident, until by this means the Paſſage of the Water, with the help of the Sluices being open, began to run ſmooth and eaſy. Beſides which, in the place where the Water firſt took power, I kept throw-

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ing in ſeveral Freights of Chalk, to keep the Water from wearing too deep by the Fall over the Dove-tail'd Piles on the Reflux of the Tide; and to ſave the Foot-Wharfs from being torn to pieces, which nevertheleſs ſuſtain'd ſome Damage in the Place aforeſaid.

FURTHER, altho there had been no Neceſſity to cut down the Works for the Reaſons above, yet it was impracticable to have repair'd the ſame again while one part remain'd ſtanding higher than the other: Therefore I was obliged to continue to cut down and level the ſame to within a foot or a foot and a half of the height which the Dam was firſt built to, above the Low-Water Mark, whereby to facilitate the raiſing and building the ſame up again, according to the Deſcription of the Method laid down in my Scheme. The more particular Reaſons for the Neceſſity of which, I thither refer to.

HAVING as much as poſſible thus prevented the Extenſion of the Evil by this Accident, I will go on to give an Account of the Repairs; and having been very particular in my Relation hitherto, that I might give Perſons of Judgment a better Idea of the Work, I ſhall have the leſs occaſion to be tedious in what follows.

IT was one great Advantage and Encouragement in this Misfortune, that my Sluices

Sluices (which were not calculated or ſuſpected to have any occaſion for the Service of them any more than once to have turn'd the Tide out of the Levels) that they ſtood firm in this Shock, and were able to anſwer the End of their Service again with very little Repair and Additional Work on the *Thames* ſide, where the Return of the back Water had went out at the time of raiſing the laſt part of my Works, with a Fall of at leaſt ſeven foot for ſome time, and had worn away the Ground to a conſiderable Depth.

DURING the Winter-Seaſon which follow'd, having made the neceſſary Repair to the Sluice, with the Damage to the Foot-Wharfs in the Breach, and made ſome additional Breadth to my Dam by a new Drift of Piles on the *Thames* ſide, to give the better Eaſe to the Fall of the Water on the Tide of Ebb, as was obſerv'd neceſſary in raiſing the Dam the firſt time: I proceeded early in the Spring of the Year to raiſe my Works in the ſame method, but with much better Earth, and a much leſs Number of Hands than I had employ'd the Year paſt. I met with the like Strugglings from my Men to advance their Wages as they had done before, and they more than once deſiſted from working for ſome Days to have forc'd me to new Terms: but having fixed a good Price of

Wages

Wages to them from the beginning for the bringing in of good Earth, and upon their Attempts to bring in that which was bad, ſtrictly rejecting it, as often as ſuch Impoſition was offer'd, they were kept to good Order, and the latter End of *June* the Tide was a ſecond time turn'd out of the Levels in the time of the Neap, as before. Only that the Work after the Tides were turn'd was now continued to be rais'd by Set-offs with Piles and Boards, and well covered over at the top; ſo that tho a thin Body of Water of about a foot depth or more, did ſeveral times in the enſuing Spring-Tides paſs over into the Levels, it was eaſily let off by the Sluices, and there enſu'd no manner of Evil therefrom. And after I had further rais'd the ſame by adding two other Set-offs, I then gave notice thereof to the Right Honourable the Truſtees, who were pleas'd to appoint a Committee to come down at the time of the ſecond Spring-Tides, which happen'd after the Breach was clos'd: which Committee having upon their View made ſuch Obſervations as they ſaw requiſite, were pleas'd to make their Report, That I had effectually perform'd that part of my Contract as ſtipulated to be obſerv'd upon the making ſuch View, which was about the 20th Day of *July* 1718.

AFTER which View, I immediately began to dam up the two Canals on the Inſide of my Sluices, and continued at the ſame time to raiſe and add more Earth on the Dam in the Breach, as it was found to ſettle, and as a new Body of Earth was natural to be expected.

WHEN the Dams in the Canals were advanced, and the ſettling of the main Dam in the Breach was found very much to abate, and being covered over with Reeds and Hurdles at the top, in more exact and effectual manner than Time and Opportunity had ever admitted in carrying up of the Works; ſo that tho an extraordinary Tide ſhould riſe above what they were then rais'd to, no Danger of any Miſchief might happen therefrom.

BEING under a Promiſe to my Lord *Aylmer*, made ſome Months before, to go down to *Dover*, to give him my Opinion of what Relief might be found to the Inconveniencies attending that Port, and his Lordſhip having writ to the Truſtees there to give me Aſſiſtance in making my Survey; I left the Care of my Works at the Breach to be carry'd on in my abſence by my Aſſiſtants, and about the 22d of *Auguſt* took my Journey thither, being at the time of Neap Tides, which I choſe for it.

THE Report which I made to my Lord of the Improvements which I found that Har-

Harbour capable of, for rendring the ſame practicable for large Ships to go in and out, and to lie always afloat with their Lading, I have hereafter tranſcribed, as being a thing tending to the common Welfare.

IMMEDIATELY upon my Return from thence, I was viſited with an intermitting Fever, or Ague, which was very rife at that time; and after ſtaying a few days at the Breach, and the Increaſe of my Diſtemper being look'd upon dangerous, I was preſs'd by my Friends to go up to *London* for my Recovery. Thereupon my Aſſiſtants, and one of my Securitys who took upon him to be at the Breach, promiſed to take care of the finiſhing the Work in my Abſence.

DURING the Time of my Illneſs I was often inform'd by Meſſages from my Aſſiſtants, and by my Friends who came from the Breach, that the compleating of my Work went on in very good order. And about a Week before the laſt Misfortune that happen'd, when I was upon my Recovery, I deſired a Gentleman who was my particular Friend (the Equinoctial Tides being then paſt) to go down and enquire how the Tides had been, and to bring me up an Anſwer to ſeveral Points which he took in Writing: amongſt other things one was, How much the Great Dam

Dam had ſettled upon the laying on an Addition of Earth, which was near finiſhing at my coming away. And the Anſwer which my Aſſiſtants return'd (as the Gentleman took it in Writing, which I have now by me) was, That it had ſettled nothing perceivable.

I ſhall not here enlarge upon the other particular Points, but only take notice, that if the Report of the Works not ſettling was true, then it was eaſy, with the Number of Men there were for it, to have rais'd and kept the ſame covered to ſuch a Height, as might have been out of all danger.

However, two or three days after *this* Account, the 25th of *Septemb.* 1718. finding myſelf gather Strength, I reſolv'd to go down to the Breach; but my Friends who were my Securitys, at a Meeting which they had on the ſame Day, urg'd and pleaded with me not to go down, telling me that I might be ſatisfy'd that what was neceſſary was taken care of, and that they apprehended there was evident danger of my Relapſe, if I went down upon the River before I was better confirm'd in Strength; and deſir'd me to deſiſt from my Reſolution for a Week, when ſome of them would accompany me to the Breach. But to my great Surprize, on the laſt Day of that Month early in the Morning, I had

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the unhappy News brought to me, that between two or three Hours before Day, a high Tide, which flow'd ſix or ſeven Inches above the loweſt Part of the great Dam in the Breach, had cut down and deſtroy'd the ſame, in ſuch manner, as was apprehended could never be recovered: Upon which, I made all the Haſte thither I poſſibly could; it was about three Quarters Flood, the next Tide after the Damage, when I arriv'd, and finding both the Sluices ſhut, and the Dams ſtanding in the two Canals, one of which being near finiſh'd to its full height, and no place cut or broke down of the great Dam, to give Vent and Eaſe to the Paſſage of the Water, which ſet in and out of the Place where the Miſchief happen'd with inexpreſſible Violence; I immediately ſent to all the Villages, where any Men could be found, and ſet them to work, to uncover and dig down the ſtanding Parts of the great Dam in the Breach; as alſo to make way and cut down the Dams in the two Canals, and open the Sluices, as ſoon as I could.

But by reaſon what was neceſſary of this kind had been wholly omitted the firſt Tide, when the Fall of the Water was very great, and would with but a very little vent have made its own Paſſage wherever it had been let looſe, as was

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ſeen by the Operation of the Miſchief the Year before, and might have been remembred by the Perſons to whom the Charge of the Work was now left; Notwithſtanding all my Application upon coming down, the Weight and Force of the Current continued ſo great, where the Miſchief firſt took its Power, that the ſixth Tide after, the Row of dove-tail Piles, originally driven in the Foundation, with the Foot-Wharfs which were made, and bound on each Side with a double Drift of other Piles, were near an hundred foot in length of the Dam, torn up and driven into the *Thames*; and before the remaining Parts of the Dam could be cut and dug down to a ſufficient depth, to make the Current tolerable eaſy, the bad ground continued for ſeveral Weeks wearing away; until, in the place where one of the Foot-Wharfs was broke down, there was near 20 Foot greater depth of Water, than when the Work was firſt begun: altho', beſides what is related to be done, as above, to eaſe the Force of the Current, there were conſiderable Quantities of Chalk daily thrown in, which was a great Help in preventing the Ground wearing deeper.

THIS Application was continued with a very conſiderable Expence, before the Work was put into the needful Security from growing worſe, which was done with

with ſome Addition of driving of new Piles at the broken Parts of the Foot-Wharfs, and ſheeting and filling them up with Chalk, *&c.* Without ſuch Means uſed, the Difficulty and Expence in a future Repair muſt inevitably have proved much greater, or perhaps not practicable to have been recovered at all, ſo as to have driven new dove-tail Piles in the place of thoſe broke down, and to join them and the Foot-Wharfs in the ſame Line with the Parts of the Work which remained ſtanding; and even in the Condition the ſame was preſerv'd to, it was doubted by many Perſons, whether it was practicable to be recovered, or not, without beginning in a new Place.

Upon my coming down from *London*, and enquiring of my Aſſiſtants how, or from whence this Miſchief took its Riſe, they told me, that the Tides did not flow above ſix or ſeven Inches higher than the Works; that the Earth at the top was as well covered over as ever it had been done, and could not rightly know or judge from whence the Miſchief proceeded; for the Watchman, who had the ſame repeated Orders given to him, as before I went to Town, That in caſe he ſhould obſerve any likelihood of a high Tide, when it flowed within two or three foot of the top of the Works,

that he ſhould not fail to come and call them out, to give their Attendance at the Time of High Water, as had been conſtantly obſerved upon other Spring-Tides; but that the Watchman appointed near the Place, where the Damage then happened, never came, nor gave them any notice of the Flowing of the Tide, until it was High Water; and the Tide went over the Works about the Depth beforementioned, as near as they could judge: That they heard the Water run over the Works at the old Booth, or Place where they lodg'd, at the time when the Watchman call'd them up; and when they came to the Dam, one of them, who firſt got there, it being a Moon-light Night, took a Bundle of Reed with him, and ran to the Place where he ſaw the Water had made its Paſſage underneath the Hurdles, in hopes to have apply'd ſome Help, but found the Earth ſo much gull'd and torn away, that it was too late, and that the Water began to take ſuch a Force, that he durſt not venture back the ſame Way which he went on upon the Dam, leſt he ſhould have been born down by the Stream. Whereas had he, with other Help that was upon the Spot, been call'd out ſooner, before the Tide was riſen to the top of the Works, they could timely have obſerv'd any Miſchief, that might have

appear'd,

appear'd, and, by the Application of Reed or Earth, have prevented any evil Effect.

WHETHER this Misfortune took its Riſe from any Leakage, or whether the Hurdles were made looſe, or how the Water came to gull the Earth, which they cover'd from underneath them, is not known; it is however evident, that there was a Neglect of Duty on this Occaſion: either the Watchman muſt have been awake upon the Works, and did ſee the Tide riſe higher than his Orders was to have done, before he call'd, or gave notice thereof, to my Aſſiſtants; or was aſleep, or abſent at an Ale-houſe, that was near: which I am the more inclinable to believe, being unwilling to think, there was any Wickedneſs purpoſely committed.

ABOUT a Fortnight after my Return to the Breach, when I had ſet my Men in full Work, having occaſion to go to *London*, and believing my Friends would be enquiring of me about the Accident, I ask'd the Watchman ſome Queſtions concerning his Neglect; but finding that he gave his Anſwers indirect and evaſive, I deſiſted from queſtioning him any farther, deſigning, as ſoon as my principal Aſſiſtant, who gave him his Orders, and was gone very ill to *London*, four or five Days after the Accident, ſhould be recovered, to have had him to a Juſtice of the Peace to

be examined; but when I was gone to *London*, he went off from the Works the next Day, leaving his Wages behind him, and was not afterwards ſeen, or heard of, till very lately, when I procur'd him, by Warrant, to be brought before Mr. *William Blacbourn*, Juſtice of the Peace for the County of *Eſſex*, and one of the Truſtees, before whom he own'd upon his Examination, that his Orders were, that in caſe of his obſerving any likelihood of a high Tide, to call out to my Aſſiſtants, when the Water came within two or three Foot of the top of the Works, for them to attend at the Time of High Water, and which he own'd had often been done at other Times, both in my Abſence, and when I was my ſelf at the Works. Upon his farther Examination, he ſaid, that he did not the Night when the Damage was ſuſtain'd go to call out any of my Aſſiſtants, till the Water was up to the Reeds, with which the top of the Works was cover'd; that my Aſſiſtants, upon the notice he gave them, immediately haſten'd to the Place, and that when he came back, though he did not ſtay any where by the way, then the Water ran over the Works; and that my Aſſiſtants came there as ſoon as himſelf. Upon his being farther examined, why he did not call them out ſooner, as was his Orders,

Orders, he own'd that he went off the Work when the Tide was flow'd about half-way the height of the Wall or upper Off-ſet, which was within 2 foot or 2 foot 3 inches of the top of the Works, which he made pretence was to pump Barges, and that when he return'd he found the Water roſe to the height before mention'd.

My Aſſiſtants depos'd at the ſame time, That he was order'd to call them out upon the Riſe of any Tide to the Height which he had acknowledg'd; That he had no Orders at all from any Perſon to pump any Barges, and that there was not any for him to pump, nor poſſible for him to come at any in the Place where they lay moor'd without ſwimming to them, at the time of the Tide which the Watchman own'd he went off the Works; which is to be obſerv'd was the very Time, which he in the fore part of his Examination declar'd his Order was to have given notice of the flowing of the Tide to my Aſſiſtants, and ſhould not have gone any other way; and which my Aſſiſtants farther depos'd, That had they then been call'd up, as they had been at other times, before the Water was up to the top of the Works, they verily believ'd all Miſchief might have been prevented.

Upon his being examin'd why he went away from the Breach without giving any

Notice, or making any Demand for his Wages at his going, or afterwards coming or ſending to demand it, he ſaid his Reaſon was, becauſe he believ'd he ſhould not have it paid him.

I ſhall not here mention any more of this Examination, which I have by me, under the Hand of the aforeſaid Gentleman, but proceed in my Account of finiſhing the ſtopping of the Breach.

THE Money which I had receiv'd from the Truſtees was very near expended by the time the Work was put into proper Security from growing worſe, as before deſcribed.

ABOUT *Chriſtmas* the ſame Winter *I* humbly apply'd to the Truſtees for the Favour of their Aſſiſtance, there then remaining in their hands 4000 *l.* part of my Contract, which was to be paid me upon the removing of the Shelf without the Breach, which I had been at conſiderable Expence to remove, and wanted but very little of being effected: but the Truſtees then, and upon a ſecond Application which I made, refus'd to order me any more Money, tho I propos'd to give Security for the Repayment of it, if I did not go through with my Undertaking.

AND upon the Eſtimate which I afterwards produced to my Securitys, that it would require between 6 and 7000 Pounds

to

to make good the Damage ſuſtain'd, I found great difficulty to unite them to raiſe a Sum amongſt themſelves for it; and had not my good Friends the *Ruſſia* Merchants, who knew me in the *Czar*'s Service, ſtood firmly by me, it is certain I ſhould never have been able to have gone through with my Undertaking.

It became now a Queſtion by thoſe who declined to advance Money, Whether the Method I proceeded in was proper? and there were many Propoſers and new Schemes now ſet up for Repairing the Work in a different manner from what I had laid down in my Eſtimate.

Beſides the Models and Propoſitions offer'd by Strangers, there was a new Model privately made by a Perſon that was near to me, and ſome of my Securitys were deſir'd to meet to view it when I was at the Breach; whereby it was propos'd that the Earth in my Dam ſhould have been but 30 foot in breadth, and to have had more Chalk uſed in the Work in the room of it; Reaſons being advanced by the Perſons who ſupported this new Model, that Chalk was preferable to Earth: but when the ſame came to be examined, the Arguments uſed were eaſily refuted by the proper Objections which my Friends made to it without once requiring my Opinion in it.

WHEN the Diſputes about the Manner of carrying on the Work were over, the Majority of my Friends came to a Reſolution to raiſe a ſufficient Sum of Money to enable me to compleat the Work, and to make Repreſentations to the Truſtees of ſuch Perſons who refuſed tocome into Meaſures with them: and tho ſome of my Securitys declined paying any Money, and continued to be troubleſome to the reſt, yet about the beginning of *February* Money was rais'd to begin upon Repairing the Damage done to the firſt Height my Works were made above the Foundation, which I forthwith took in hand; but by reaſon of the great Depth of Water and Labour in making good the ſame, together with the Backwardneſs of ſome of my Friends to furniſh the needful Supplies of Money, it was not till *September* following that I made ſome Repairs to my Sluices, compleated the Foot-Wharfs, and made a Cloſe by a Drift of Dove-tail Piles in the Foundation of my Dam to the height above the Low-water, as had been at the firſt done. And before the whole place of the Damage ſuſtain'd was ſquar'd and fill'd up with Earth to the aforeſaid height, the greateſt part of the Winter was expir'd.

EARLY in the Spring I began to carry up the Works for turning the Tides out of the Levels. Thro the difficulty of finding good

good Earth, which was now at a greater diſtance to be brought than at the other times of raiſing my Works, and by ſome Neglect in the Covering of the Earth with that Care as ought to have been done, when the Dam was carry'd about two thirds up, and the Force of the Tide paſt in and out with the greateſt Fall and Violence, I met with an Accident that gull'd away the Earth in ſuch manner, that was very near obliging me to cut down and level my Dam to the height that the ſame was firſt made to above the Low-water Mark. Alſo I had another Accident which had like to have proved very miſchievous to one of my Sluices; but however, by timely applying of Remedy, all Misfortune was prevented, and on the 18th of *June* laſt the Tide was the third time turn'd out of the Levels: The Work being carry'd up with good Earth by proper Off-ſets, and taking the Time of Neap-Tides for it, as had been done before.

When the Tides were turn'd, being able then to do the Work which remain'd in the Day-time, without attending the Tides in the Night, I doubled the Watch in the Places neceſſary, and order'd my Aſſiſtants likewiſe to take their Turns to look out in the Night, at all Spring-Tides.

As the Body of Earth, in the Dam ſettled, I continued a ſufficient Number of Men to raiſe and gain upon the ſame, till I was above the Height of the Common Spring-Tides, and then ſet Hands to work to make the Dams for ſtopping up the two Canals; and by a conſtant Attendance in raiſing them, as well as the main Dam in the Breach, I advanced them the ſame Summer to ſuch Height and Perfection, that the extraordinary Tide which happen'd in the Month of *November* laſt, occaſion'd by a Storm of Wind, and the Moon's being then in her Perigee, or neareſt Approach to the Earth, (which is always obſerv'd to have a ſtrong Influence upon the Tides, either at the Full or the New) did not riſe to the Top of my Works by near a Foot.

The Builders in the River of *Thames*, whoſe Buſineſs of docking of Ships, *&c.* obliges them to be very mindful of the Tides, tell me, That the aforeſaid late Tide exceeded any that has been known in their Memory; and the Damage that was done at that Time, by the overflowing of the Banks, more or leſs, of all the Levels in the *Thames*; and having made a Breach below *Erith*, and in two Places between *Grays* and *Graveſend*, (which, by timely Application, have been recovered) together with the Damage in many Places not yet fully repair'd in the Hundreds of *Eſſex*, *&c.* abundantly confirm what thoſe who

hav

have made their Obſervations in the *Thames* relate.

I have ſince, nevertheleſs, continued to raiſe and augment the Strength of my Dams, to a Subſtance and Height beyond the Banks in any other part of the *Thames*, being upwards of 4 Foot and a half higher than at the Time of the Damage in the Year 1718, and near 2 Foot above the late great Tide, and which do not now ſettle any more that can be diſcerned; alſo I have ſo finiſh'd and compleated all the other Parts of my Contract, as, I hope, will be entirely ſatiſfactory to the Truſtees, (whom I expect to make their View in a ſhort time) as well as effectual for preſerving the Navigation of the River from danger any more for ever, where the Breach is now ſtopp'd.

As I have ſpent upwards of 5 Years of my Time in the Performance of this Work, and have met with ſo many adverſe Accidents, that I have been obliged three times to ſtop the Breach, attended with more than common Labour; and whereas, had I ſucceeded the firſt time I turned the Tides out of the Levels, I had both been exempted from all the Difficulties I have ſince met with, happy in having a ſufficient Compenſation for my Labour in it, and have gone a great way, by this time, in performing ſome other Work: So, on the contrary, the Weight of my Misfortune, is ſo much the heavier upon me, not only

only that I have expended my Time and Labour, but have moreover been obliged to enter into very conſiderable Debts and Engagements, to enable me to compleat my Undertaking, very much beyond the Sum I contracted for with the Truſtees; which, without I am relieved in, I muſt be liable to continual Actions and Impriſonment, and debarr'd from any further Induſtry the future part of my Life: Therefore I hope the Honourable the Truſtees, in their Juſtice to me, will now pleaſe to remember their Promiſe, or Agreement with me, upon my entering into Contract with them for Twenty-five Thouſand Pounds, That in caſe I did effect the Work, and that the ſaid Sum ſhould by means of any unforeſeen Accidents, prove deficient, they would recommend me to the Honourable Houſe of Commons, to be reimburſed ſuch Money as my Contract ſhould fall ſhort of, and for ſuch a Reward to myſelf as the Houſe ſhould pleaſe to order.

If I may (now the Work is compleated, and ſo many Years ſpent therein) be but freed from the Debts and Engagements into which it has plung'd me, and ſet at liberty to offer myſelf upon ſome other Work, whereby I may be of uſe to my Country, and have Opportunity of getting my Bread; I ſhall chearfully ſubmit to what-

whatſoever ſhall be thought fit, as to any Conſideration or Reward to myſelf.

A Foreign Miniſter reſiding at this Court, has lately received Orders from his Maſter, to take my Opinion about a particular Service, propos'd to be of Benefit to his Dominions; and the ſaid Miniſter, upon my Anſwer return'd thereto, aſſur'd me of ſuitable Encouragement, if I will go thither.

I have, in the foregoing Pages, made mention of my having view'd the Ports of *Dublin* and *Dover*, and ſhall be glad if the Service which I have propos'd for either of thoſe Places may be acceptable.

As to the firſt of which, there having been no Experiment, as I know of, yet practiſed in the World with tolerable Succeſs, for the Relief of Bar Places, which are known to be attended with frequent Misfortunes and Miſery; and being well ſatisfied, that what I have to offer, particularly with relation to the Bar of *Dublin*, (which is not a ſhifting Bar) may be depended to be made to ſuch a Depth as I have propoſed to that City, and when once fix'd, maintain'd with very ſmall Trouble and Expence for Thouſands of Years to come: And I ſhould be very glad if I might have the Opportunity of ſhowing an Inſtance of ſuch Service, if that City ſhould now revive the Thoughts of it;

and

and in caſe the ſame may be eſteem'd of any Conſequence for Cruiſing Ships in the time of War, I am ready (if requir'd) to ſubmit the Scheme which I have by me, to be examined by ſuch Perſons of Judgment as may be thought proper.

Secondly, As to the Method hereafter tranſcribed, relating to the Port of *Dover*; I have ſince my Delivery of it to the late Lord *Aylmer* been inform'd, that the ſame thing, or to the like effect, as to the firſt part of what I propos'd for preventing the rolling of the Beach from choaking up the Entrance into the Peer, was recommended to ſome Gentlemen of the Town, by Mr. *Acworth*, preſent Surveyor of his Majeſty's Navy, before my going thither; and the Means which they have ſince uſed, have been ſo effectual, that they now ſtand in no Apprehenſion of the Mouth or Entrance into the Peer, being any more choak'd up by the Beach that has annoy'd them; and Beacons (or Marks) in nature as I propos'd, for Ships to run in by Day, and Lights by Night, at the proper Time of the Tide for it, have been ſet up according to the Publication made in the Gazette, in the Months of *October* and *November* laſt.

When I was at that Port, the Commiſſioners (or Truſtees) appointed by Act of Parliament, acquainted me with the Surveys

Surveys which had been made, and Endeavours us'd, beginning from the great Sir *Walter Rawleigh*, until the making of my View in the Year 1718; and as nothing hath been yet done, nor no Propoſal before been offer'd for rendring that Port commodious for Entertainment of large Ships to go in and out, and to lie a-float with their Lading: So I humbly ſubmit what I have propos'd, whether it be not the only poſſible Method for it, and worthy of Conſideration to be put in practice for the Publick. And as, in my Opinion, by reaſon of the Nature of the Ground, the chief Difficulty will be in fixing the Foundation (or Apron) of the Sluice, for making the Baſon propos'd, to ſuch a Depth as may be required for rendring the Port commodious for Men of War, as well as Merchant-Men; ſo I ſhall be very glad of the Honour, if I may be aſſiſting in it.

A Copy of which is as follows:

TO

TO

The Right Honourable

The Lord *AYLMER*.

My LORD,

IN Obedience to your LORDSHIP's Commands, I have been lately down, and carefully ſurvey'd the Port of *Dover*; and, to the end that the Obſervations which I have made, and what I ſhall propoſe for the Amendment of that Harbour, may be the better apprehended, I ſhall firſt take notice of the Inconveniences and Diſadvantages that now attend it, together with the Deficiency in all the Deſigns or Attempts hitherto made to remedy the ſame.

THE firſt great Evil, which is complain'd of, and known to attend that Harbour, is, that when the Wind blows hard from the Sea, towards the South and South Weſt,

Weſt, it cauſes a great Drift of the Ballaſt or Shingle to ſett along the Shore, which lodges before the Peer, and choaks up the Mouth of the Harbour, ſo that no Ships or Veſſels can enter, until the Wind, or Weather changes; and that there is Time and Opportunity to clear the Mouth of the Harbour, by the Methods they now practiſe for it: and though this does not happen ſo often as is reported, yet the very Notion and Apprehenſion of it deters Men (eſpecially when the Wind blows any thing ſtrong from the Sea) from attempting to put into a Port, where they are not certain of the true Depth of Water at the Entrance, to bring them into Safety.

THE next obſervable Inconveniences or Diſadvantages which attend that Harbour, are theſe; *Firſt*, That the Water ebbs away every Tide, and leaves the large Space between the Mouth of the Peer, and Dam, or Croſs Wall, (as they call it) belonging to the Baſon, for the moſt part wholly dry. *Secondly*, That there is now ordinarily not above ten foot Water over the Apron, or Cell of the Gates, belonging to the Entrance into the Baſon upon a Neap Tide. *Thirdly*, That there is much leſs Water within in the Baſon, than there is at the Entrance, ex-

cept it be for a ſmall Space near to the Gates. *Fourthly*, Although there were a better Depth of Water poſſible to be made, yet there is ſo little room in the preſent Baſon, that it is generally pretty well filled with leſſer Veſſels, and not capable of entertaining both them and any conſiderable Fleet of others. *Fifthly*, The Dam, or Croſs Wall, is ſo injudiciouſly made, that the Water cannot be penn'd up in the Baſon to any conſiderable height above the Neap Tides: And when there happens to be any occaſion for ſcowering away the Beach from the Mouth of the Peer, the Water is then uſually let wholly off, or the greateſt Part of it, and all, or moſt of the Ships in the Baſon, left dry on the Ground. *Sixthly*, There is only one ſingle Pair of Gates made for the Entrance of Ships; ſo that if any Ship or Veſſel whatſoever has a mind to come into the Baſon, when the Water is ebb'd but an Inch below the height that it is penn'd up to, it is impoſſible to open the Gates, to let any Veſſel whatſoever into the Baſon; inſomuch, that the Ships, which the Baſon is now capable of entertaining, if they judge the Water to be fallen, muſt either take Care not to come at all into the Port, or be obliged to lie a-Ground without the Baſon, in the Space between that and the Peer before mentioned. So

that

that through theſe ſeveral Inconveniences it is, that no Ships of large Burthen, and but very few of leſſer Depth of Water, in compariſon of what the Harbour is eaſily capable of being improv'd to, can now practiſe the coming in and out of the Port, with the Convenience of having room enough when they arewithin, and of being ſure to lie always a-float with their Burthens. And it is a Thing, no doubt, well known to your Lordſhip, that all Maſters or Commanders of Ships, particularly thoſe who uſe the Southern Trade, whether outward or homeward bound, are very careful, when they are laden, not to come near the Ground, or willingly to come into any Place, where there is any Danger of the Waters ebbing away from them, leſt they ſhould ſtrain and damnify their Ships, more eſpecially ſuch as are ſharp and built for Sailing: And that likewiſe the ſame Regard ought to be had for Ships of War, to take Care not to come any where to lie on the Ground, until their Ships are lighten'd, and they are ſure of a proper Place to take no Damage in.

HAVING thus mention'd the ſeveral Diſadvantages which attend this Harbour, I ſhall now offer my humble Opinion for the Remedy thereof. And firſt as to the Obſtruction at the Entrance into the Peer,

occaſion'd by the Drift or Rolling of the Beach or Shingle along the Shore; what I would propoſe is, *Firſt*, to make ſeveral low narrow Jetties, (or Break-Waters) extending from the top of the Beach down to the Low Water Mark, upon the ſame Deſcent or Slant as the Beach lies, and not above two or three foot height above the Surface of the Beach, to be built as well to the Eaſtward, as to the Weſtward of the Peer, as far as the Town extends; which low-built Jetties will require no great Charge to be made, and afterwards to maintain in Repair.

THE next Thing I propoſe, is, in a more ſtrong and effectual Manner to carry out the Peer, on the Weſt Side of the Entrance, into the Harbour, at leaſt 150, or 200 foot farther into the Sea, than has ever yet been done, extending more into deep Water, and into the ſtronger Courſe of the Current, as it ſets along the Shore. As to the Eaſtermoſt Peer, I would not carry that much farther, or rather let it remain as it is, until Time ſhall ſhew the Practice of running in and out with one Peer only; which, I believe, will be ſufficient for it, there being not known any Beach to annoy or choak the Harbour by any Drift from the Eaſtward; which, as I remember, I was inform'd by the Pilots belonging to the Port:

and,

and, when there is only one Peer carry'd out, it will, as I take it, be the leſs dangerous for Ships, which have been known to ſuffer by their miſſing the Entrance, and being caſt, by the Force of the Tide, againſt the Eaſt Peer. But if the Weſtward Peer be made of a greater length, and a Ship, when the Wind hangs Weſtwardly, by the Force of the Tide that runs thwart the Peer, ſhould be thrown a little too much to the Eaſtward, that ſhe cannot luff up again, when the Wind hangs Weſtward, as aforeſaid, ſhe may inſtantly let go her Anchor; or, if Warps with Buoys, for that Purpoſe, are fixed at proper Places, Ships may, by taking hold of them, eaſily warp in or out under the Slack or Eddy of the Peer, the Courſe of the Tide along the Coaſt being known always to ſet to the Eaſtward, from the half Flood to half Ebb: and that Ships may, with more Conveniency, take hold of ſuch Buoys, they may have Hooks fixed to the Strap, to receive the Bite of a Rope being caſt from any Ship. And a farther Reaſon why I propoſe a ſingle Peer, for the preſent, to be carry'd out to ſuch Diſtance, is, that I believe the Harbour will be thereby freed from being choaked up any more for ever, by the Means of any Drift of the Beach. But as I ſhall hereafter propoſe a much larger

Quantity of Water to be penn'd up in the Harbour, than has ever yet been; ſo, if ever it ſhould happen, that a ſmall Matter of Beach ſhould at any time lodge, it will be much eaſier to ſpare Water for the ſcowering it away; and the Obſervations which I ground my Opinion upon, are theſe that follow,

I HAVE been inform'd, both by the Commiſſioners, whom I had the Honour to wait on at *Dover*, and by many of the Pilots, as well as by Gentlemen of Underſtanding, Inhabitants of the Town, that ſome Years ſince, within their Memory, there fell down a Clift of Chalk, or Rocks, ſome Diſtance to the Weſtward of the Town; and, by its Fall, ſhot itſelf into the Sea, and lay upon a Slant above the Surface of the Beach, from High to Low Water Mark, by which Accident, the Beach became wholly ſtopp'd for many Years from driving along the Coaſt, and during all ſuch time the Mouth of the Harbour was entirely free from being choak'd up until the Beach, by means of the ſaid Clift lying far to the Weſtward, began to wear quite away from before the Town; and the Inhabitants thereupon became apprehenſive, that there was Danger of the Sea's waſhing away, not only the Beach, (which there was no ſmall Jetties made to ſupport and prevent) but

even

even of wearing away the Bank, and breaking through the Walls of the Baſon: they therefore, through this Apprehenſion, blew up and levell'd the ſaid Clift, and let the Beach come on again to the Harbour's Mouth, as before, and which now lies under the Diſadvantage of being frequently choaked up thereby.

ANOTHER Inſtance of the ſame kind, which I was alſo inform'd of, is, That there lately happen'd another Clift to fall down into the Sea to the Eaſtward, juſt under the Foot of the Caſtle, which continued ſeveral Years to lie above the Surface of the Beach: and that it was very remarkable, the Beach was thereby wholly ſtopp'd from being driven at all to the Eaſtward, but gather'd and lodged wholly between the ſaid fallen Clift and the Mouth of the Peer, until the Clift, by the Operation of the Waves of the Sea, was waſh'd and worn level, or equal with the Surface of the Beach; and that the Beach, in bad Weather, now wears away again from out of the Bay to the Eaſtward of the Peer, and rolls on towards the South Foreland, as it did before.

THESE two Inſtances of Accidental Cauſes which have happen'd, I think may give ſufficient ground for a ſtrong Preſumption that if an Artificial Jetty be built out to a further diſtance than what

was occaſion'd by either of the aforeſaid Accidents, no Beach will paſs the ſame ſo as to ſubject the Entrance of the Harbour to any Annoyance thereby; eſpecially if low ſnug Jetties or Break-waters are built in two or three places to the Weſt of the Peer, and five or ſix to the Eaſtward, extending near as far as the foot of the Caſtle: which ſmall Jetties may be eaſily made with no very great Charge in the doing. And there may likewiſe be a ſmall Foot-work made at the Low-water Mark to the Eaſtward of the Peer, the better to preſerve the Beach from being waſhed away, that now lies in the Bay a conſiderable diſtance from the Shore up as high as the High-water Mark; but as I remember, there is none appears at Low Water, ſo that the Ground there is free and convenient for the making of ſuch a ſmall Foot-work, if there ſhould prove any Occaſion.

THE next thing which I ſhall propoſe, that Ships may be both certain to have a better Depth of Water when they come into the Harbour, and to lie always afloat with their Burthens, is as follows.

A little within the Mouth of the Peer, as is laid down by the pricked Line in the Draught, there to make a Dam for the penning up the Water to the ordinary Height of the Spring-Tides, and to fix down a large Sluice with double Gates for the

the Entrance of Ships into the Baſon: for which purpoſe I propoſe the Apron to be placed about three or three foot and a half deeper than the Apron of the preſent Gates that are fixed in the Croſs-Wall or Dam, at Letter *C.* in the Draught.

And the Reaſon why ſuch Sluice ought to be made with double Gates, one Pair at a proper diſtance without the other, is to the end that all Veſſels whatſoever, as well before as after High Water, or at the loweſt Neap Tides, whenever they have Depth enough to come in within the Mouth of the Peer, and to enter upon the Apron of the firſt Pair of Gates, that then they may by the Practice of raiſing and lowering the Water in the Space between the two Pair of Gates, paſs in or out of the Baſon at pleaſure, altho there be ſeveral foot difference of Level between the Height of the Water in the Baſon and that in the Sea; for the Water within in the Baſon muſt be conſtantly kept up to the neceſſary Height, that Ships when they come in within the Baſon may lie afloat, and not have the Water ebb'd away from them: which Method of double Gates is what was lately made at *Mardyke*, and is the only commodious and proper Way known in the World, for the Practice of receiving Ships or Veſſels in and out, of either any Natural or Artificial

cial Baſon, where there is not otherwiſe Water enough for the Conveniency of Ships to lie afloat, but by the being pent up by Sluices.

And for the Purpoſe of entertaining any Conſiderable Number of great Ships, ſo that they may, particularly in the Winter-Seaſon, when they are outward bound, and the Wind hangs contrary, gladly chuſe this for a Place of Safety as much preferable to the *Downes*, where ſo many Ships with their Cargoes, which are known frequently to be driven from their Anchors, have been loſt, and Mens Lives periſhed with them; but in this place Ships may both lie perfectly ſafe, and be in equal readineſs to put to Sea when the Wind preſents fair for it. In which caſe I do not know that they will be under any diſadvantage of putting to Sea, but when the Wind happens to be about Eaſt-South-Eaſt; and then if it be any thing of tolerable Weather, they may alſo eaſily put to Sea, by the help only of a Warp to an Anchor for that purpoſe, laid right out from the Head of the Peer; and when it blows hard about the Eaſt South-Eaſt, even Ships which ride in the *Downes* are ſeldom known to attempt putting to Sea.

And to the end there may be ſufficient room for the Entertainment of Ships in this Harbour, it will be neceſſary at the

ſame

ſame time when the Sluice ſhall be made, to level and cleanſe all the Space at Letter *B.* which will remain between the new Dam which I propoſe and the Croſs-Wall belonging to the preſent Baſon: which place alone I believe will then contain upwards of ſeventy Sail of Ships, from about 14 to 17 foot Draught of Water, and do believe that the preſent Baſon when alſo deepen'd and cleans'd equal to the Level of the Apron of the preſent Gates, (which are to be broke down and taken away) and that the Water ſhall afterwards be conſtantly pent up by the help of the New Dam and Sluice to the Height of the common Spring-Tides; That then about ſixty Sail of Ships drawing from 10 to 14 foot Draught of Water may be entertain'd in this place: and for other ſmaller Ships and Veſſels, a ſufficient place may without any great Charge be made either at Letter *N*, or at the Letter *K*, or place called the upper Pent in the Draught laid down.

SHIPS of 14 or 15 foot Draught of Water is what I propoſe to run in and out in the ordinary Courſe of the Neap, or between the Spring and the Neap Tides, without being pinched for want of Water in the Harbour; but at the top of the Spring-Tides ſuch Friggots as may be appointed to clean or refit, as well as other Ships from

from 15 to 17 foot Draught of Water and upwards, may then very ſafely go in or out.

And thoſe Ships before named of leſſer Burthen, drawing 14 and 15 foot, they may at the time of Spring-Tides depend upon the going in and out of the Port with their Lading, upwards of an hour and a quarter before, and near an hour after High Water: As alſo for the Practice of ſmaller Ships, thoſe of 13 foot Draught of Water may at Spring Tides go in an hour and minutes, thoſe of 12 an hour and minutes, thoſe of 11 an hour and minutes, thoſe of 10 an hour and minutes before, and about two thirds as much time after High Water. And the Difference between the time of Entrance upon the Neap Tides will, I believe, ordinarily not prove above three quarters of an hour leſs: and for all leſſer Ships and Veſſels, they will in proportion to the Depth of Water which they draw, have always the more time both before and after High Water for their paſſing either in or out of the Baſon. Alſo there will be a ſmall Space left without the Baſon to entertain ſuch Ships or Veſſels, which are not apprehenſive of ſuffering any Damage from lying on the ground, or that purpoſely chuſe it, to clean or refit, for which Uſe there may be a proper Place made for Ships without the Baſon, as well as Convenience

ence to be made for careening of Ships within the Baſon; and where alſo a Place may be found for making of a dry Dock, if thought fit.

Laſtly, In caſe of ſuch Works and Baſon being made as above propos'd, for the better Certainty and Guide for Ships coming in and out of the Port, it will then be neceſſary that a more exact and regular Calculation ſhould be made and publiſh'd to the World, for every Day of the Moon's Age, the Depth of Water which ſhall by ſuch Computation be reckon'd to be upon the Apron of the Sluice, the Hour and Minute of the Day, as well upon the Flood as the Ebb; ſo that Ships may be thereby able to make ſure and ſufficient Allowance for the time of their running in, when, perhaps they may be obliged to it without a Pilot; and for which Purpoſe, in caſe of Extremity of Weather, when it may be difficult for Pilots to come off, proper Beacons may be ſet up, ſo that Ships, eſpecially that are any thing acquainted, may venture to run in without a Pilot: and Lights alſo, if thought fit, may be ſet up for the coming in by Night, when fair Weather may make it practicable to do it.

Thus, my Lord, I have laid down my humble Opinion of the Improvements this Harbour is capable of, the Performance of which

which will not only prove advantageous and agreeable to ſuch Ships as ſhall paſs this Way, but extend to the common Benefit of the Kingdom in general.

For it very often happening that Ships are obliged to lie a Month or ſix Weeks Wind-bound in the *Downes*, beſides the common Wear and Loſs of their Ground-Tackle, it is too well known that there is more Riches frequently loſt in one Storm by Merchant-Ships being driven from their Anchors in the *Downes*, than would make this a common Place of Safety for a very conſiderable Number of ſuch Ships.

And your Lordſhip can beſt judge how great an Expence would be ſaved, and what Advantage would accrue in Time of War, by making this a Port convenient for Cruizing Ships.

The Charge of doing this Work, tho by reaſon of my Buſineſs requiring me in another Place, I had too ſhort a time in taking my View, to make my Computation to any Exactneſs; yet, I do believe it may be depended upon not to exceed the Sum of Thirty, or Five and Thirty Thouſand Pounds, eſpecially if the Stone in and about *Dover-Caſtle*, which is not any way of uſe there, be order'd to be employ'd in the Performance of this Work.

SUBMITTING the whole to your Lordſhip's Judgment and Favour, I remain, with my utmoſt Duty,

My LORD,

Novemb. 1718.

Your Lordſhip's Moſt Obedient,

And Moſt humble Servant,

J. PERRY.

This Report or Propoſal for the bettering of the Port of Dover, *I found amongſt my Father's Papers ſince his Death, ſigned by Captain* Perry; *which, at his Requeſt, I have return'd to him this* 12th *of* October, 1720.

AYLMER.

An

An ABSTRACT *of the Indenture of Covenants for the ſtopping of* Dagenham-Breach, *made between the Right Honourable the Truſtees, appointed by Act of Parliament for that Purpoſe, of the one part, and Captain* John Perry, *of the other part, bearing Date the* 26th *Day of* January, 1715.

CAptain *Perry* covenants, That in Conſideration of 25000 *l.* covenanted to be paid to him in the Manner as in the ſaid Indenture is mentioned, he will before the 1*ſt* of *November*, 1717, effectually make up, and ſtop the Breach, in the Levels of *Havering* and *Dagenham*, being of the Width of 400 Foot; and repair and make good the Walls, Banks, and other Works, ſo that after ſtopping the Breach and the Tides ſhut out of the Levels, upon a View at any time to be appointed, there ſhall not be obſerved any Leakage thro the Dam, occaſioned by the Preſſure of the higheſt Tides, ſo as to ſwell or raiſe the Water on the Inſide of the Creek (or Works) the fourth part of an Inch, which View ſhall be taken by 15 Truſtees, 10 (of whom not more than 5 ſhall be Land-owners) to be nominated by the Truſtees at their general Meeting, and the other 5 by the ſaid *Perry*.

THAT

THAT he will before the ſaid 1ſt of *November*, repair with good Scarfing the Walls or Banks belonging to the Levels, for 200 Yards on each ſide of the Breach, ſo, and in ſuch manner, as to prevent the *Thames* for 3 Years, after ſtopping the Breach, from breaking into and overflowing the Levels, by reaſon of any Defect of the Walls or Banks of the ſame, by all the Length or Space aforeſaid.

THAT in caſe he ſhall think it neceſſary, in order to the more ſpeedy ſtopping the Breach, to make any new Cut or Cuts in the Walls or Banks, that then he ſhall within Six Months from the time of ſtopping the Breach, make good ſuch Cut or Cuts, in ſuch manner as to prevent the *Thames*, for Fifteen Months, from the time of repairing the Cut or Cuts, from breaking in and overflowing the Levels, by reaſon of any Defect, in that part of the Wall, wherein ſuch Cut or Cuts ſhall be made.

THAT before the ſaid Firſt of *November*, or within Six Months after ſtopping the Breach, he ſhall make, and fix a ſufficient Sluice, to the Satisfaction of 15 Truſtees appointed as aforeſaid, or the major Part of them, ſo as the ſame be not more than one Foot lower than the old Sluice in *Havering* Level, for the dreining and carrying off the Back-Waters from the ſaid Levels.

THAT he ſhall before the ſaid 1*ſt* of *November*, well and ſufficiently repair and amend all the ſaid Walls and Banks, from *Rainham*-Creek, to the half-way Tree, and maintain the ſame for 15 Months after the Breach is ſtopp'd, in ſuch effectual manner, that the Tides ſhall not break into and overflow the Levels by reaſon of any Defect or Imperfection in the Walls, by all the Length and Space aforeſaid; and alſo, that the Walls ſhall be made of the full Height as the oppoſite Walls of the Levels on the other ſide of the *Thames*, or of the ſame Height with the Walls of the Levels next above Weſtward, or next below Eaſtward, to the Levels, in the Judgment of 15 Truſtees appointed as aforeſaid, or the major Part of them.

THAT he ſhall forthwith, after ſtopping the Breach, begin to work upon the Sand-Bank without the Mouth of the Breach, in order to remove it, and ſhall within 18 Months, to commence from the 23d of *April*, 1718, remove the ſaid Sand-Bank, ſo that the Water ſhall be full ſix Foot deep at Low-Water Mark, at a Neap Tide, in the Judgment of 15 Truſtees, choſen as aforeſaid, or the major Part of them; ſo as they do view the ſame, within 40 Days next after he ſhall give notice, that the ſaid Sand-Bank is removed.

THE

THE Truſtees covenant to pay Captain *Perry* in the whole 25000 *l.* as follows, *viz.* not more than 15000 *l.* before ſtopping at Low-water, and 6000 *l.* more within 30 Days after he ſhall have ſtopped the Breach, and turn'd the Tides out of the Levels, according to his Contract, upon his becoming bound at the Receipt of every Part thereof, by Bond with one or more Sureties to be approv'd by the Truſtees, for Repayment of all ſuch Money as he ſhall receive, in caſe he ſhall not perform the ſeveral Parts of his Contract, namely, the maintaining the Walls from *Rainham*-Creek to half-way Tree, for the Space of 15 Months, and the Breach itſelf and Walls for 200 Yards adjacent, for the Space of 3 Years next after ſtopping the Breach, and a View and Report made thereof by 15 of the Truſtees choſen in manner aforeſaid; or in caſe of Accidents, do not make good the Damage: and the remaining 4000 *l.* within 30 Days after Removal of the Sand-Bank.

THAT the Security Bonds ſhall be deliver'd up to be cancell'd, when the Conditions are perform'd.

FINIS.